Topic: Fundamental Unit Of Life

Cell as a basic unit of life: A cell is called basic unit of life because it performs all the functions like intake of food materials, excretion and metabolism, respiration etc. For this a cell usually possesses a number of components or cytoplasmic structures called cell organelles. Each cell organelle performs a function like cleanings waste material, making new materials, protein synthesis etc. This results in division of labour inside a cell. Since life functions are the same in all types of cell, the various cells possess same cell organelles despite belonging to different organisms and performing different functions.

Cell as structural and functional unit of life: Cell is the structural and functional unit of life. When cells of same size, shape and materials combine, they form a tissue. When these tissues combine, they form an organ. When organs combine, they form an organ system. When organ systems combine, they form an organism. In this way cell is the structural unit of life.

Each cell performs its own specific functions. Hence, cell is also functional unit of life.

Discovery of Cell: The invention of microscope helped in the discovery of cell. The first microscope was constructed by Anton Von Leevwenhock (1632- 1723). It consisted of a single biconvex lens and was known a simple microscope.

Cell was discovered by Robert Hooke in 1665. Robert Hooke, an English Botanist, observed thin sections of cork of a tree under a self designed

compound microscope and noticed honey comb like compartments. He coined them as cells. The term cell was derived from a latin word "cellula" which means a little room. He explained his observations in a book namely "micrographia". He actually observed the rigid cell walls of dead cells.

Anton-Von-Leevwenhock (1674) a Dutch draper was first to observe living cells like bacteria, erythrocytes, sperms and protozoans.

N.Grew (1682) proposed cell concept which states that cell is a unit of structure of organisms. Robert Brown (1831) discovered the nucleus in the root cells of orchid plants.

Durjadin (1835) discovered a semi fluid living material in certain protozoans and named it as, "Sarcode".

Perkinje (1839) gave the term protoplasm for the jelly like semi fluid material of the cell.

M. J Schelden found that all plants are composed of cells. Theodore Schwann (1839) stated that all animals are made up of cells.

Rudolf Virchow (1855) a German physiologist proposed theory of lineage which states "Omnis- cellula-e-cellula" which means that new cells are formed from the pre-existing cells.

Haeckel (1866) established that nucleus is responsible for storing and transmitting hereditary characters.

Knoll and Ruska (1932) of Germany designed the electron microscope which was employed to study ultra

structure of cell and various cell organelles in 1940's.

Cell theory:- Cell theory was presented by Schielden and Schwaan in 1839. According to them, all living organisms are composed of cells and cell is the structural and functional unit of life. Later on discoveries led to the modification of cell theory and the modified cell theory is called modern cell theory. The various points of this theory are:-

1. All living organisms are composed of minute units called cells which are smallest entities that can be called living.

2. A cell is a mass of protoplasm containing a nucleus and bounded by a cell membrane and in many cases by a cell wall also.

3. All cells are basically alike in structure and metabolic activities.

4. The function of an organism as a whole is the result of the activities and interactions of constituent cells.

5. New cells arise from pre-existing cells.

Classification of living organisms on the basis of number of cells:-

According to the number of cells, all living organisms present on earth can be classified into following two types:- *'

Non-cellular organisms:- Which do not contain any cell in their body organization, e.g. viruses.

Cellular organisms:- Which contain either one or many cells in their bodies e.g. bacteria, plants and animals.

Prokaryotic and Eukaryotic cells:-

a) *Prokaryotes*:- These have primitive and incomplete cells. Prokaryotic cells have all three basic structures of a typical cell but lack nuclear membranes around their genetic substances- e.g. bacteria, cynobacteria.

b) *Eukaryotes*:- These have advanced and complete cells. These cells contain membrane bound cellular orgarielles and are called eukaryotic cells.

Prokaryotic cells	Eukaryotic cells
Size of the cell is generally small (1-10um)	Size of cell is generally large (5-100um)
Nucleolus is absent.	Nucleus is present
It contains single chromosome.	It contains more than one chromosome.
Membrane bound cell organelles are absent	Cell organelles such as mitochondria, plastids, ER etc. are present.

Cell division takes place by fission or budding.	Cell division occurs by mitotic or meiotic cell division

Cell principle:

i) The cell principle states that life exists only in cells.

ii) Living objects are composed of cells and cell products and are multinucleate mass of protoplasm or like a single free cell.

iii) A cell is a small mass of protoplasm usually containing a nucleus or nuclear materials and some other organelles bounded by a cell membrane.

iv) A cell organelle does not survive alone.

v) Cell is also a unit of function, reproduction, heredity and disease besides being a unit of structure.

vi) Cells always arise from the pre-existing living cells by division.

Cell principle is better than cell theory as:-

i) It applies almost to all living things i.e. plants, animals and micro-organisms

ii) It incorporates nearly all the modern findings about a cell.

Variations in cell shape, size, number, and volume.

i) *Cell shape*:- The basic shape of a eukaryotic cell is spherical but the shape of the cell is ultimately determined by the specific function of the

cell. Thus the shape of the cell may be variable or fixed. Variable or irregular shape occurs in Amoeba and white blood cells. Fixed shape of cells obcurs in most plants and animals.

In unicellular organisms the cell shape is maintained by tough plasma membrane and exoskeleton. In multicellular organisms the shape of a cell mainly depends on its functional adaptation and partly on the surface tension, viscosity of the protoplasm. The mechanical force exerted by the adjoining cells and rigidity of cell membrane. Thus cells have diverse shapes such as polyhedral spherical (eggs of many animals), spindle shaped (smooth muscle fibres), elongated (nerve cells), branched, discoidal (R.B.C's) and so on.

Cell size:- The size of the cell varies considerable in different animals and plants. The average cell size varies from 0.5 - 20 microns in diameter. In human body, the smallest cell is R.B.C (7 microns in diameter) and longest one is the nerve cells which reach a length of about 90-100cm. In plants, large cells occur in many algae among the plants, the largest is the ovule of cycus. The smallest known is mycoplasma or PPLO (Pleuro Pneumonia like organism). Its size is 0.1 - 0.5 microns. Among multicellular animals the largest cell is the egg of Ostrich. It measures about 15cm and 8cm in diameter with and without its cell respectively.

Cell Number:- The number of cells in living beings differ from the one in unicellular organisms to many in multicellular forms. The no. of cells is not definite in multicellular organisms and may increase along with growth and volume of organism. However, green algae, Pandorina

contain 8-32 cells. A human body weighing 80kg is estimated to have 60,000 billion cells, whereas a newly born human infant has $2x10^{12}$ cells. The number of cells in most multicellular organisms is indefinite but the number of cells may be fixed in some multicellular organisms such as some nematodes.

The phenomenon of having a constant and genetically fixed number of cells is called eutely. In eutelic animals mitosis stops following embryonic development.

Cell volume:- The volume of a cell is constant for a particular cell type and is independent of the size of its organism e.g. kidney or liver cells are about the same size in bull, horse and mouse. The difference in the total mass of the organ or organism depends on the number and not on the volume of cells. Thus, the cells of an elephant are not necessarily larger than those of other tiny animals or plants. The large size of the elephant'is due to the larger number of cells present in its body.

Q *Why is the cell called the functional unit of life?*

Each cell acquires a distinct function due to the organization of its membrane and cytoplasmic organelles in the specific way. Such an organization enables the cells to perform basic functions such as respiration, obtaining nutrition, clearing of waste material, forming new proteins etc. The cell is therefore the basic functional unit of living organisms.

Characteristics of a cell:-

Each cell consists of three main functional parts:-

i) Plasma Membrane or cell membrane.

ii) Nucleus

iii) Cytoplasm

i) *A limiting Plasma Membrane*:- The outer boundary of the cell is plasma membrane. It is selectively permeable as it allows selected movement of molecules like water, food and oxygen to enter the cell and waste substance to leave the cells.

ii) *Nucleus*:-It contains a set of genes. It is the control centre of the cells. It contains genes that help to transfer hereditary information from parent cell to daughter cell during cell division.

iii) *Cytoplasm*:- It contains metabolic machinery. It is a jelly like or fluid like substance, which consists of the cell organelles like Mitochondria, Golgi complex, ER etc. All the activities of the cell are carried by the organelles found in cytoplasm.

iv) *Protoplasm*:- It is a jelly like viscous colourless, semi fluid substance in which various cell organelles and inclusions remain in colloidal form. Protoplasm includes all the components of the cell including cell membrane. However, it does not include cell wall and contents of vacuoles. Protoplasm can be differentiated in two forms:-

a) Cytoplasm b) Nucleoplasm

v) *Cytoplasm*:- Is that part of the protoplasm which surrounds the nucleus and nucleoplasm is that protoplasm which is located inside the nucleus.

vi) *Plasma Membrane*:- Every cell is bound by a thin, delicate membrane called plasma membrane or cell membrane, plasma-lemma.

vii) *Molecular structure*:- Plasma membrane is living, ultra thin, elastic, transparent, electron microscopic, re-generative and selectively permeable membrane present in both prokaryotic and Eukaryotic cells. Chemically it is composed of 32% phospholipids, 42% protein, 6% oligosaccharides, 2% cholesterol and 18% water. Different models have been given from time to time to study its detailed structure.

viii) *Daniel and Davison Model (1935) or Trilaminar Model:-*
According to this model plasma membrane is formed of a bimolecular layer of phospholipids sandwiched between two layers of proteins. The three layers are a result of the same arrangement of proteins and lipids.

Unit Membrane concept or Unit Membrane Hypothesis (1950):- This model was proposed by JD Robertson. According to this model, all biological membrane share the same structure i.e. thickness of about 75°A.

b) Characteristic Tri laminar appearance when viewed with an electron microscope

Fluid Mosaic Model (1972):- S.J Singer, G. Nicloson proposed fluid Mosaic Model to explain the structure and functions of plasma membrane. According to this model plasma membrane is made up of a bilayer of phospholipids and two types of protein molecules are floating about in this layer. Intrinsic or internal proteins completely span the lipid

bilayer and extrinsic or external proteins occur either on the outer surface or on inner surface of the plasma membrane. Usually, branched oligosaccharids molecules are present on the exposed surface of the plasma membrane. They are associated with proteins as glycol proteins as well as with lipids as glycolipids. cholesterol molecules are inserted between the phospholipids molecules of plasma membrane to stabilize the membrane. Fluid Mosaic Model is also described as a number of protein ice bergs floating in the sea of the lipids". It is the most excepted Model. Since it provides explanations regarding the properties and organization of plasma membrane.

Functions of plasma membrane:

i) It gives shape to the cell.

ii) It maintains individuality of cell.

iii) It protects the cell from injury.

iv) It keeps the cell contents in place and prevents their mixing with the extra cellular fluid.

v) It is selectively permeable so it regulates the flow of selected materials into and out of the cell.

vi) It forms organelles within the cytoplasm.

vii) Its junctions keep the cells together.

Transport of materials across plasma membrane:-

Cell membrane allows the movement of different materials across it differently. Following mechanisms are involved in the entry and exit of various materials:-

i) Physical process ii) Biological process

1) *Physical process*:- These processes are slow and do not expend energy. These occur down the concentration gradient and do not use carrier proteins. Physical processes do not show specificity for the materials to be transported across the cell membrane. Only small molecules pass through the plasma membrane by these processes. They include:

i) *Diffusion* ii) *Osmosis*

2) *Biological processes*:- These processes are .rapid and often use energy in the form of ATP. These can occur down as well as against the concentration gradient and often use carrier proteins. These processes show specificity for the materials across the membrane. Large complex molecules pass through the plasma membrane by these processes. They include:-

i) Mediated transport.

Facilitative transport or diffusion transport

Active transport

ii) Endocytosis

Phagocytosis

Pinocytosis

iii) Exocytosis

Diffusion: The process by which a substance uniformly spreads into another substance by random movement of its particles from a region of higher concentration to a region of its lower concentration due to their kinetic energy is called diffusion.

Significance of diffusion:

i) Diffusion helps in the distribution of various substances throughout the cytoplasm of the cell without much delay.

ii) It helps in the exchange of respiratory gases between body cells and their environment.

iii) Various materials such as gases, liquids and solids dissolve in medium i.e. air or liquid by diffusion.

iv) Loss of water vapour from the ariel parts of plants occur through diffusion

v) Flowers of plants spread aroma by the process of diffusion. It attracts insects and other animals for pollination.

Osmosis:- The diffusion of water or solvent through a selectively permeable membrane from a solution of lower concentration of solute to a solution of higher concentration of solute is called osmosis.

Activity to describe osmosis:- Take a tumbler filled with water and add a thistle funnel containing solution and cover the mouth of the funnel with

a selectively permeable membrane. We will observe that the level of the solution inside the funnel will rise. This describes the process of osmosis from the solution of less concentration of solute to the solution of high concentration of solute through a selectively permeable membrane.

Types of solution:

i) *Hypotonic solution*:- If the medium surrounding the cell has a higher water concentration than the cell i.e. if solution is very dilute, the cell will gain water by Osmosis. Such a dilute solution is called hypotonic solution.

In this case, water molecules are free to pass across the plasma membrane in both directions, but more water will come into the cell than will leave. The (overall) result is that the water enters the cell. In such a situation cell is likely to swell up i.e. become inflated or turgid.

ii) Isotonic solution:- If the medium surrounding the cell has exactly the same water concentration as the cell, there will be no net movement of water across the plasma membrane. Such a solution is called isotonic solution.

In this case, water crosses the plasma membrane in both directions, but the amount going in is the same as the amount going out. So there is no overall movement of water. In such a situation the cell will stay of the same size.

iii) *Hypertonic solution*:- If the medium has a lower water concentration of water than the cell, i.e. if it is very concentrated solution, the cell will

lose water by Osmosis. Such a concentrated solution is called hypertonic solution.

In this case too, water crosses the plasma membrane in both directions, but this time more water leaves the cell than enters it. Therefore the cell will shrink. In this situation, plant cell is said to be plasmolysed and animal cells is called to be crenated.

Osmosis with Human RBC's:-

Clean your ring finger of your left hand with spirit and prick it with a disposable needle. Take three drops of blood on a plain side and mark them as A, B and C. To drop A add a drop of Ringer solution. This solution is used as an isotonic solution. To drop B add a drop of water and to drop C add a drop of concentrated salt solution. Observe the blood drops under a microscope. Circular, biconcave, non-nucleated red blood cells are seen in drop A. In drop B, RBC's appear swollen and haemolysed/bursted. In drop C, RBCs appear shrunken (crenated).

Diffusion	Osmosis
Diffusion can occur in any medium. The diffusing molecules may be solids, liquids or gases.	It occurs only in liquid medium. It involves movement of solvent molecules only.
Semi permeable membrane is not required.	Semi permeable membrane is required.

Equilibrium in free energy of diffusing molecules is achieved in the system.	Equilibrium in the free energy of solvent molecules is never achieved.

Types Of Membrane:

i) *Permeable membrane:-* It is a type of membrane that allows all the substances to pass through it.

ii) *Semi-permeable membrane:-* The membrane which allows solvent molecules to pass through it.

iii) *Impermeable membrane:-* A membrane which does not allow any substance to pass through it. iv) Selectively Permeable Membrane:- A membrane that allows some selected molecules to pass through it.

Mediated Transport:- Mineral nutrients, sugars, aminoacids and many other substances required for the biological activity are transported across the cell membrane with the help of transport proteins or permeases. Permeases form a small passage way through the membrane, enabling the solute molecule to cross the phospholipid bilayer. This transport is called mediated transport.

Types of Mediated Transport:

It is of following two types:-

1) *Facilitated transport/ diffusion:-* In this case, the permease assists a molecule to diffuse through the membrane that it cannot otherwise penetrate.

2) *Active transport*:- In this case, the energy is supplied to the system (called pump) to transport molecules in the direction opposite to concentration gradient. In active transport, molecules are moved uphill against the forces of passive diffusion. It always involves the expenditure of energy because materials are pumped against the concentration gradient.

3) *Bulk transport of Materials*:- It involves transport of large amount of substances across the plasma membrane by utilizing energy. Special processes are involved in the transport of such large quantities of materials. These include:

i) *Endocytosis*:- It is the process by which animals engulf food and other substances from external medium by plasma membrane. In simple way, the term 'endocytosis' refers to ivagination of a small region of plasma membrane and ultimately forming an intracellular membrane - bound vesicle. For instance, a unicellular Amoeba acquires food through this process. Depending upon the intake of fluid droplet or solid particles, endocytosis is of two types:-

a) *Pinocytosis*:-It is the non-specific intake of a tiny droplet of extracellular fluid by a cell through the cell membrane which can't otherwise pass through it. It is also, therefore termed as cell drinking. It was first observed in Amoeba. In this process, a small region of plasma membrane invaginates and the fluid droplet passes into the pocket so formed. This pocket is called caveola. The pocket depends and finally nips off as a fluid-filled vacuole called pinosome or pinocytotic vesicle. The pinosome then shifts into the interior of the cell. Pinocytosis may be

importat in the : movement of the substances from one side of a cell to other.

b) *Phagocytosis*:- It is the intake of solid particles by a cell through cell membrane. It is also called cell eating. Phagocytosis is the major feeding method in many unicellular organisms and simple metazoa. It is also the means by which leucocytes of blood, microbes e.g. viruses, cellular debris etc. in the blood are taken in such cells are called phagocytes. An area of the plasma membrane comes in contact with the food particles. The contact induces the cell membrane to put out tiny protoplasmic processes, the pseudopodia around the food particles. The pseudopodia meet on the other side of the food particles and fuse. In this way, an internal vacuole called phagosome, containing food particle in a droplet of water is acquired.

Thus both pinocytosis and phagocytosis processes are important.

a) Bring materials into the cell by invagination and subsequently formation of a vesicle and

b) Carry segments of cell membrane into the cytoplasm.

ii) *Exocytosis*:- It is the process that involves fusion of membrane of the exocytotic vesicle with the plasma membrane to extrude its contents to the surrounding medium. This process is also called cellular vomiting or ephagy and the vesicles that turn out the materials are termed exocytotic vesicles.

Exocytotic process is responsible for:

i) Removal of undigested food left in the food vacuoles in the cell.

ii) Secretion of substances such as hormones, enzymes , and

iii) Replacement of internalized membrane by the fusion of exocytotic vesicles with the cell membrane.

Cell wall:- It was first seen in cork cells by Robert Hooke in 1665. It is present in plant cells, bacteria and

fungi cell wall is a thick, non-living, rigid and permeable covering made up of cellulose. It is an additional protective wall present outside plasma membrane. It provides structural strength to the plant. It is secreted by the cell itself to protect its content.

Cell wall is formed of peptidoglycans in bacteria and blue-green algae but is formed of Chitin in most of the fungi.

Structure: Cell wall is composed of three layers:-

i) Middle lamella

ii) Primary cell wall

iii) Secondary cell wall

i) *Middle lamella:-* It is thin, sticky, amorphous layer of cementing material between two adjacent cells. It is absent on outer surface. It is made up of calcium and magnesium pectate.

ii) *Primary cell wall:-* It lies inner to middle lamella. The thickness varies from 0.1-3 microns and it has the property of extension. It is made up of cellulose. But in fungi, it is made up of Chitin.

iii) Secondary cell wall:- It lies inner to the primary cell wall and thickness varies from 3-10 microns.

It is made up of number of layers S1 , S2, S3,.....Sx. Thickness of S2 is more than S1 and S3.

Sometimes S3 becomes different in its composition and that time it is called as tertiary cell wall. At places, the cell wall remains thin as secondary cell wall is not formed here. Such area is called pits or pores. Through these pits small cytoplasmic strands called plasmodesmata pass which form inter cellular connections that allow exchange of materials between the adjacent living cell contents.

Functions:

i) It maintains the shape of the cells. It protects the cell from mechanical injury and prevents their desiccation.

ii) It provides mechanical support against gravity. It allows the materials to pass in and out of the cell.

iii) Plasmodesmata form intercellular connections that allow exchange of materials between adjacent living cell contents.

Plasmolysis:- When a living plant cell loses water through Osmosis there is a shrinkage or contraction of protoplasm away from cell wall. This is called plasmolysis.

Thus, if a living plant cell is emersed in a concentrated sugar-solution. The concentration of water molecules inside the cell will be higher than outside.

As a result water will move by osmosis from higher water potential inside the cell to lower water potential outside. The cell contents will shrink away from the cell wall and it will get plasmolysed.

Types of plasmolysis:

i) *Limiting Plasmolysis*:- Gradual loss of water from plant cell causes protoplast to stop exerting pressure on the cell wall. It is the beginning of plasmolysis.

ii) *Incipient plasmolysis*:- As the water flows out from the vacuole the cytoplasm along with plasma membrane shrinks and starts separating from cell wall from corners.

iii) *Evident plasmolysis*:- When protoplast shrinks and all the contents come to rest at one place. This phenomenon is called evident plasmolysis.

De plasmolysis:- It is a condition when a cell regains its normal turgidity when placed in water or in hypotonic solution.

If a piasmolysed cell is kept in water or a hypotonic solution, water molecules diffuse into the cell by endosomosis and the cell gradually regains its normal turgid conditions. This is called de-plasmolysis.

Forms of osmosis:

Osmosis is of two types: i) Endosmosis ii) Exosmosis

i) *Endosmosis*:- It is the entry of water molecules into the cells through selectively permeable plasma membrane when surrounded by hypotonic solution.

ii) *Exosmosis*:- It is the exit of water molecules from the cells through selectively permeable membrane when surrounded by hypertonic solution.

Mitochondria:

Mitochondria were first seen by Kolliker (1880) in muscle cells but it was Benda (1898) who named them as mitochondria. They are present in all aerobic eukaryotic cells. However, they are absent in prokaryotic cells and mammalian RBC's. Typically, mitochondria are sausage-shaped, but these may be granular, filamentous, rod-shaped, spherical or thread-like also.

Mitochondrion is a thermos bottle-like structure and has two mitochondria! membranes. Outer mitochondrial membrane is smooth, porous and freely permeable while as inner mitochondrial membrane is selectively permeable and is deeply folded into finger-like processes, called cristae, to increase the surface area. The cristae are arranged in characteristic patterns in different cells and bear ATP-generating assemblies called oxysomes or elementary particles or F0 - FI particles. The two membranes of each mitochondrion are separated by a narrow space called inter-membrane space or outer chamber. It contains a clear, homogenous fluid. The space between the cristae is called inner chamber. Inner chamber of mitochondria is filled with circular and denser proteinaceous mitochondrial matrix having respiratory enzymes;

It also has 70 S ribosomes and a number of circular and naked DNA and RNA molecules.

Inner membrane folds create a large surface area for the generation of ATP during respiration. This energy is required for various chemical activities needed for life. Hence, mitochondria are also known as the powerhouses of the cell or storage batteries. ATP is known as the energy currency of the cell.

Functions

i) Mitochondrial are miniature biochemical factories where food is oxidized and energy is released. This energy is stored in the form of ATP (Adenosine triphosphate). Hence, mitochondria are called the powerhouses of the cell.

ii) They provide important intermediates for the synthesis of several biochemicals like chlorophyll, cytochromes, steroids, etc.

iii) Synthesis of many amino acids occurs in mitochondria.

iv) Mitochondria are capable of self duplication (replication). They have DNA, RNA, ribosomes and enzymes. They are able to synthesize some of their own proteins. Hence, they are regarded as semi-autonomous organelles.

Plastids:

The term 'plastid' was given by Haeckel in 1886. They are spherical or discoidal in shape and are enclosed in double membrane. They are present only in plant cells. These are absent in the prokaryotes, fungi

and animal cells. Plastids are also self-replicating bodies. They contain their own DNA, RNA and ribosmes, i.e. they have their own protein synthesising machinery hence are called semi-autonomous bodies.

Chloroplasts: These are green-coloured plastids containing chlorophyll.

Leucoplasts: These are colourless plastids, which store starch, protein and lipids in them. There are three types of leucoplasts:

i) Amyloplasts: They are the starch containing leucoplasts e.g. rice, wheat,

ii) Elaioplasts (Lipidoplasts, Oleplasts): The colourless plastids store fat, e.g. tube rose, iii) Aleuronplasts, Proteoplasts or Proteinoplasts: The plastids contain protein (e.g. aleurone cells of maize grain, endosperm cells of Castor). *Chromoplast*: These plastids are yellow or reddish in colour and are present in flowers and fruits. Structure of chloroplasts: The chloroplasts of higher plants are usually spherical, ovoid, discoidal or lens shaped. Each chloroplast is a vesicle bounded by double membrane envelope and filled with fluid matrix like the mitochondrion. The outer membrane is smooth and freely permeable to small molecules. Inner membrane is however, selectively permeable. It has carrier proteins that control the passage of molecules. It is greatly infolded but the in-folds become free in the mature chloroplasts to lie as lamellae in the matrix. Lamellae are closed; flattened, membrane-bound ovoid sacs called thylakoids which lie closely packed in piles, the grana (singular granum). These contain green chlorophyll pigment molecules. Matrix is a colourless, granular, colloidal ground substance called stoma. It contains proteins, lipids, Ribosomes

circular DNA, RNA molecules, enzymes, lipid droplets and certain metal ions.

Functions:

i) Leucoplasts store the reserve food in the form of starch grains or oil droplets or proteins,

ii) Chromoplasts help in pollination and dispersal of seeds and fruits,

iii) Chloroplasts are sites of photosynthesis.

Ribosomes:-

These are dense, spherical, granule like particles about 150-250'A° in diameter. These were first discovered by Robinson and Brown in 1953 and by George Palade in 1955 under electron microscope. Hence, these are also called Palade particles. Their size is determined by the speed with which they sediment in the centrifugal field. The Svedberg (S) is the unit to measure sedimentation Co-efficient.

Occurrence:-

Ribosomes are found in all prokaryotic and eukaryotic cells. In prokaryotic cells, they float freely in the cytoplasm. In eukaryotic cells, they occur free in the cytoplasm and are also attached to the cytoplasmic surface of the RER and nuclear envelope. Ribosomes are also found in the matrix of mitochondria and the stoma of plastids in eukaryotic cells.

Types:- On the basis of their size and sedimentation co-efficient, ribosomes are of two types:

i) 70S ribosomes ii) 80 S ribosomes

i) *70S ribosomes*: These are found in prokaryotic cells and in the mitochondria and plastids of eukaryotic cells. Each 70S ribosome consists of a large 50S sub unit and a small 30S sub unit.

80S ribosomes: These occur in eukaryotic cells. Each SOS ribosome consists of a large 80S subunit and a small 40S subunit.

Structure:-

Both types of ribosomes are similar in structure. They are minute organelles without a membrane around them. Chemically, both the ribosomal subunits consist of RNA and proteins.

Functions:-

Ribosomes provide space for the synthesis of proteins in the cell. Hence, they are known as 'protein factories'of the cell.

Cytoplasm:-

The substance of a cell between the nucleus and the plasma membrane containing various organelles and cell inclusions is called cytoplasm. It consists of various molecules such as water, salts, proteins, nucleic acids and a variety of enzymes. Chemically, it contains about 90% water, 7% proteins, 2% carbohydrates and lipids and 1% organic materials, vitamins, minerals etc.

Cytoplasm is differentiated into two parts:-

i) *Matrix or Cytosol or Hyaloplasm*:- It is the ground substance which is differentiated into outer, denser and non-granular ectoplasm (plasmagel) and inner fluidy and granular endoplasm (plasmasol).Matrix shows streaming movements, called cyclosis, which helps in uniform distribution of materials.

ii) *Cytoplasmic structures*:- These lie in the cytoplasm and are of two types.

a) *Cell organelles*:- The sub cellular components of a cell are called cell organelles or small organs e.g. nucleus, mitochondria etc.

b) *Cell inclusions or ergastic bodies*: - The non-living materials present in the cytoplasm, are called cell inclusions e.g. stored organic food, inorganic crystals etc.

Endoplasmic reticulum (ER):-

It was discovered independently by Porter in 1945 and Thompson in 1945. The name endoplasmic reticulum was coined by Porter in 1953. Endoplasmic reticulum is a complex network of membranous system in the cytoplasm of eukaryotic cells. At places, on one side it is connected with plasma lemma and on other side, it is connected with nuclear envelope. ER is absent in prokaryotic cells and mature RBC's of mammals. Depending on the nature of its membrane, ER is of two types:

a) *Rough Endoplasmic Reticulum or Granular Endoplasmic Reticulum*:- It is called so because of the presence of ribosomes on its surface for synthesizing proteins.

b) *Smooth Endoplasmic reticulum or A granular Endoplasmic Reticulum*:- It is called so because it is devoid of ribosomes and is meant for synthesizing fats or lipids.

Endoplasmic reticulum exists in three forms: Cisternae, vesicles and tubules.

Functions:

1) The network of ER separates cytoplasm of the cell into several small compartments. This compartmentalization of cytoplasm helps a cell to perform specific functions within specific chambers excluding others.

2) Some of the proteins and lipids, which are synthesized in the cell with the help of ER, are utilized in building the cell membrane. This process is known as membrane biogenesis. 3) The ER gives mechanical support to the cytoplasm by providing a kind of cytoskeleton to maintain the shape of cell. 4) The ER offers extensive surface for the synthesis to protein and lipids. It also helps in the transport of materials especially proteins from one part of the cell to another or between the cytoplasm and the nucleus.

5) The SER brings about detoxification in the liver of vertebrate, i.e., it converts harmful poisons and drugs into harmless substances for excretion by the cell.

Golgi complex

Nature and occurrence:-!! It is also known as golgi bodies or golgi apparatus. It was first seen by George (1867) but is named after Italian scientist Camillo Golgi, who is 1898, recognized the apparatus in the nerve cells of owl and cat. Its structure was studied under electron microscope by Dalton and Felix (1954). In plants, golgi apparatus in present in sub units as called dictyosomes. Golgi complex is absent in prokaryo'tes. It is present in all eukaryotic cells except red blood cells of man.

Structure:

The shape and size of Golgi complex is not fixed. Usually golgi complex is made up of four parts-cisternae, tubules, vesicles and vacuoles.

Cisternae:- Golgi complex consists of a stack of generally 4-8 membrane bound cisternae or saccules. The membrane of saccules or cisternae is smooth but of variable thickness. It encloses a lumen of 60-90 A°. Lumen contains a fluid substance called matrix.

Sacculesfor cisternae are frequently curved. One face of the apparatus is convex while the other is concave. The convex side is called forming

or cisface while the concave side is called as maturing or transface. The forming or cis face receives vesicles from ER. Their contents pass through various cisternae and reach the maturing or trans face where they are budded off as secretions, vesicles or vacuoles.

Tubules:- They form a complex or complicated network towards the periphery and maturing face of the apparatus. They have a diameter of 30-50nm. The tubules are interconnected with the different cisternae.

Vesicles- They are small sacs of 20-80 nm diameter. The vesicles are found attached to the tips of tubules at various levels in the network. Vesicles are of two types,

i) Smooth and

ii) Coated.

Smooth vesicles have a smooth surface which contain secretary substance and are hence called as secretion vesicles. Coated vesicles have rough surface and have protein on its membrane.

Vacuoles:- These are the expanded parts of the cisternae which have become modified to form vacuoles which contain amorphous or granular substance. Some of the vacuoles function as lysosomes.

Functions of Golgi complex

1. It is involved in cell secretion and acts as storage modification and condensation or packaging membrane as it accumulates enzymes, mucus, hormones etc.

2. It forms the acrosome of sperm and secretory vesicles.

3. It participates in the formation of lysosomes.

4. It is a seat of biosynthesis of polysaccharides.

5. It is involved in the synthesis of cell wall and plasma membrane.

Lysosome:

Nature and occurrence: It was discovered accidently by Belgian scientist Christian de Duve in 1955 in rat liver cells. Lysosomes were observed under electron microscope by Novikoff in 1956. He also coined the term Lysbsome.

Lysosomes (Gk-lysis - digestive or loose and soma - body.)

These are small vesicles which are bounded by a single membrane and contain hydrolytic enzymes in the form of minute granules of 5-8 nm diameter and evenly distributed in cytoplasm. About 40 enzymes have been recorded to occur in them. All the enzymes don't occur in the same lysosome but there are different sets of enzymes in different types of lysosomes.

Lysosomes contain digestive enzymes for intracellular digestion; hence lysosomes are also called as digestive bags. The digestive or hydrolytic

enzymes are synthesized by R.E.R. Lysosomes also remove the worn out" and poorly working cellular organelles by digesting them to make way for their new replacement.

In this way, they remove the cell debris. So, these are also called as housekeepers of the cell.

As long as lysosome membrane is intact, enzymes are inactive. The enzymes once liberated destroy the entire cell, hence they are also called as suicidal bags.

Structure:

Lysosomes are generally rounded but can be irregular. The diameter varies from 0.2 - 0.84um but sometimes it may grow to a large size. The interior may be almost solid or differentiated into outer denser region and central less dense mass with granular content. Lysosomes occur in all animal cells with the exception of RBC'S.

Depending upon their functions, lysosomes are of four types:

1. Primary lysosomes
2. Secondary lysosome
3. Residual bodies
4. Autophagic vacuoles.

1. *Primary lysosomes*:- They are newly pinched off vesicles from golgi apparatus. The primary lysosomes are small in size. They contain hydrolytic enzymes in the form of granules.

2. *Secondary lysosomes*:- It is formed by the fusion of food vacuoles with lysosome where digestion occurs. The digested food passes out into cytoplasm and the secondary lysosomes is left with only undigested food.

3. *Residual bodies*:- These are those lysosomes in which only undigested food materials have been left. The residual bodies pass outwardly and fuse with the plasma membrane to throw out the debris into external environment by exocytosis.

4. *Auto phagic vacuoles*:- They are produced by the fusion of a no. of primary lysosomes around worn out or degenerate intracellular organelles where these organelles are digested. This phenomenon is known as auto phagy or auto digestion.

Functions:

1. Lysosomes help in digestion of food.

2. Extracellular digestion is also performed by lysosome by releasing their enzymes to outside through exocytosis.

3. Lysosomes provide natural defense to the body by destroying foreign particles, toxins etc.

4. During starvation, lysosomes provide nourishment by rapidly hydrolyzing the organic foods stored in the cells.

Vacuoles:

Vacuoles are fluid filled or solid filled membrane bounded spaces present inside the cytoplasm. Vacuoles are believed to be formed from E.R. They are a kind of storage sacs. In animal cells, vacuoles if present are small and temporary. In plant cells, vacuoles are large, distinct and permanent. In mature plant cells, the vacuole occupies almost the entire volume of the cell. Because of the central position of vacuole, nucleus and other cell organelles are pushed to the periphery. It is done in order to facilitate the rapid exchange between cytoplasm and the surrounding environment. Depending upon the contents and functions, vacuoles are of four types:

1. Sap vacuole
2. Contractile vacuole
3. Food vacuole
4. Air vacuole

Sap vacuole:- They are fluid filled vacuoles which are separated from the cytoplasm by a selectively permeable membrane called tonoplast. A no. of small sap vacuoles occur in animal cells and young plant cells. In mature plant cells, the small vacuoles fuse to form a large single central vacuole. The fluid present in the sap vacuole is often called sap or vacuolar sap. It contains mineral salts, sugars, aminoacids, proteins,

waste products and water soluble pigments called anthocyanins (red, blue, purple) and anthoxanthins (ivory to deep yellow). They provide coloration to flowers and attract pollinating and dispersing agencies.

3. *Contractive vacuoles*:- They occur in some algal cells found mostly in fresh water. A contractile vacuole has a highly extensible and collapsible membrane connected to feeding canals (paramecium). The feeding canals obtain H_2O from the surrounding cytoplasm. They pour this water into the contractile vacuole. The vacuole swells up. The swollen contractile vacuole comes in contact with plasma membrane and collapses. Thus throws the vacuolar contents to outside. Contractile vacuole thus takes part in osmoregulation and excretion, (maintain concentration, and Osmotic pressure of H_2O).

4. *Food Vacuole*:- A food vacuole is formed by fusion of phagosome and a lysosome. The food vacuole contains digestive enzymes with the help of which nutrients are digested. The digested materials pass out into the surrounding cytoplasm.

5. *Air vacuoles* (Pseudovacuoles, gas vacuoles):- They have been reported only in prokaryotes. An air vacuole is not a single entity. It consists of a no. of small sub microscopic vesicles. Each vesicle is surrounded by a protein membrane. It encloses gases. An air vacuole not only stores gases but provides buoyancy and mechanical strength.

Functions:

Vacuoles help to maintain osmotic pressure in a cell. They store toxic products in plant cells. They provide turgidity and rigidity to the cell.

Nucleus

It is a double membrane bound protoplasmic body which contains all the genetic information for controlling cellular metabolism and transmission of characters from parents to offsprings.

Nucleus was first observed by Leuwenhoek in R.B.C's offish. Though nucleus was first studied in orchid root cells by Robert Brown in 1831 nucleus is present in all living eukaryotic cells with the exception of mature sieve cells of plants and RBC's of mammals.

Number: Commonly cells are uninucleate that is they posses single nucleus. Paramecium is binucleate i.e. it has two nuclei(macronucleus and .micro nucleus). Muttinucleate or polynucleate condition is found in some cells of bone marrow, striated muscles etc.

Position: Nucleus is commonly situated in the centre of the cell. In plant cells, it is pushed to peripheral position 'on one side due to the development of a large central vacuole. Nucleus is peripheral in fat storing cells or adipocytes and basal in glandular cells.

Shape: The nuclei are generally rounded in outline. They appear oval or elliptical in plant cells. Disc shaped nuclei occurs in cells of squamous epithelium, lobed in WBC's and irregularly branched in some

insects. ' Structure: A typical nucleus is 5-25 um in diameter. It is differentiated into four parts:

1. *Nuclear envelope* (Karyotheca)
2. *Nucleoplasm*
3. *Chromatin*
4. *Nucleolus*

1. *Nuclear envelope*:- Nuclear envelope separates the nucleus from cytoplasm. It is a double membranes each of which is 60-90 A° thick. The inner membrane is smooth. The outer membrane may be smooth or may bear ribosomes. The two membranes are separated from each other by perinuclear space. The space is 100-700A^0 in width. The outer membrane is often connected with ER.

Nuclear envelope contains a large no. of pores or perforations called nuclear pores which control the passage of substances to outside of nucleus.

2. *Nucleoplasm*:- Nuclear sap or karyolymph: It istransparent, semi fluid substance which fills the nucleus. It contains nucleotides and a number of enzymes which are required for the synthesis and functioning of DNA.

3. *Chromatin*:- It is a network of long and fine threads which during cell division, condense by dehydration and spiraling occurs to form number of rods called chromosomes which are rod shaped or thread like deeply stainable condensed chromatin fibres. A chromosome is formed

of two identical threads called sister chromatids which are joined at centromere or primary constriction. Chromosomes are formed of DNA and proteins (histones). DNA forms the genes which are functional units of chrorhosomes and acts as unit of heredity.

4. *Nucleolus*:- It is naked, round or slightly irregular structure which is attached to chromatin at a specific region called nucleolar organizer region (NOR). Commonly 1-4 nucleoli are found in nucleus. A covering membrane is absent around nucleolus. Calcium seems to be essential for maintaining its configuration. It contains RNA and proteins and is the site of formation and storehouse of RNA so it helps in the synthesis of ribosomes.

Functions:

1. If directs all the cellular activities of the cell.

2. It contains genes which help to transfer hereditary formation from parents of offsprings.

3. It regulates the cell cycle.

Topic:Tissue

Definitions:

1. *Differentiation*: It is the process of qualitative changes in the cells to perform different functions in living organisms.
2. *Primary growth*: It is the increase in length that results from cell division and differentiation of an apical meristem.
3. *Secondary growth*: It is the increase in width or girth that results from cell division and differentiation of lateral meristem.
4. *Vascualar bundles*: It is the conducting tissue of a plant that is formed of xylem and phloem.
5. *Monocot*:- These are the plants whose seeds have only one cotyledon. Example, corn seeds, Rice, garlic, etc.
6. *Dicot*:-These are the plants whose seeds have two cotyledons. Eg. Beans, peaches, etc.
7. *Sarcomere*:- The smallest functional unit of myofibril which occurs as repeated units along the length of myofibrils.
8. *Myofibril*: It is a muscle fibre which is basic rod like unit of a muscle.
9. *Nerve impulse*: It is a self-propagated electro-chemical current that travels from one neuron to another for the passage of message.
10. *Synapses*: It is the functional junction between neurons.

Tissue:

A tissue may be defined as a group or cluster or collection of similar or dissimilar cells that perform or help to perform a common function and have a common origin.

The word 'tissue' is derived from a French word 'Texo' meaning 'to weave'. It was first given by a French Biologist namely 'Bichard'. Study of tissues is called 'Histology'.

Types of Tissues: There are two types of tissues:

1. Plant Tissues.
2. Animal Tissues.

1. *Plant Tissues*:

Plant tissues are divided into two types:

i) Meristematic Tissues ii) Permanent Tissues

i) *Meristematic Tissues*:-

They are simply called Meristems. They are formed by a cluster of cells. They have the ability to divide continuously. They never stop dividing.

When they stop dividing, they result in the formation of permanent tissues. When they divide continuously, they help a plant to increase in length as well as in girth. They are responsible for both primary growth as well as the secondary growth of a plant.

Characteristics of meristematic tissues:

1. The cells of meristematic tissues are similar in structure and have thin and elastic cell walls made of cellulose.
2. The meristematic cells may be oval, rounded, polygonal or rectangular in shape.
3. They are compactly arranged without intracellular spaces between them.
4. Each cell contains dense and abundant cytoplasm and a large prominent nucleus.
5. It contains few small vacuoles or no vacuoles at all.
6. New cells are produced, take up a specific function and lose the ability to divide and thus form permanent tissue.

Occurrence:

Depending upon the occurrence and position in the plant body, meristematic tissue is divided into three types:

i) Apical meristem.
ii) Lateral meristem.
iii) Intercalary meristem.

i) *Apical meristem*:-

This meristem is located at the growing apices of main and lateral roots, stems and leaves. These cells are responsible for linear growth of an organ. It thus, results in the increase in the length of plant which is called primary growth.

ii) *Lateral Meristem*:

This meristem occurs on sides almost parallel to the axis of roots, stems and its branches.

It brings about an increase in the width or girth of the plant which is called as secondary growth. Lateral meristem is of two types.

1. Cork cambium
2. Vascular cambium

1. Cork cambium: The lateral meristem which occurs beneath the bark of a plant is called cork cambium.

2. Vascular cambium: The lateral meristem which occurs in vascular bundles of dicots is called vascular cambium.

iii) Intercalary meristem:-

This meristem is located at the base of leaves or at the base of node and internode. It is also present in the regions of permanent tissues. It is responsible for growth in length.

3. ***Permanent Tissues***:

It may be defined as a group or collection of living or dead cells formed by meristematic tissues and have lost their ability to divide and are permanently placed at fixed positions in plant body.

Characteristics Of Permanent Tissues:

1. They constitute a major portion of plant body.
2. Their cells have lost the power of division.
3. Cells are mature, thin or thick, living or dead.
4. These may be oval, rounded, polygonal, elongated, etc.
5. They have intercellular spaces.
6. They have vacuolated cytoplasm.

Simple Permanent Tissue:-

It is a type of permanent tissue which is composed of similar type of cells. These cells are structurally and functionally similar. On the basis of nature of cells, simple permanent tissues are divided into three types:

1. Parenchyma
2. Collenchyma
3. Sclerenchyma

1. *Parenchyma*:-

It is derived from two words 'para' meaning 'besides' and 'enchyma' meaning 'to pour' or 'enchein' meaning 'in fillings'.

General characters:

1. It is most simple and unspecialized primitive tissue.
2. It mainly consists of thin walled cells which have intercellular spaces between them.
3. Cell wall is made of cellulose or calcium pectate.
4. Each cell has a prominent nucleus and vacuolated cytoplasm.
5. Cells are living and perform metabolic activities/ processes.
6. It forms the basic packing tissue of plant body and is the most abundant tissue of the plants.

Shape: Cells may be isodiametric, spherical, cylindrical, rectangular, stellate or long spindle, etc.

Distribution: Parenchyma is widely distributed in various plant organs i.e. roots, stems, leaves, flowers and fruits. They are found in endosperm of seeds, xylem and phloem. Types

Parenchyma is of three types:

1. Storage parenchyma
2. Arenchyma
3. Chlorenchyma

1. Storage parenchyma: It is that type of parenchyma in which cells enlarge and store nutrients and water e.g. starch in the parenchyma of potato.

2. *Arenchyma*: It is that type of parenchyma that has large air cavities to give buoyancy to the plant e.g. aquatic plants like hydrilla.

3. *Chlorenchyma:* It's that type of parenchyma that contains chloroplasts and thus performs photosynthesis e.g. leaves.

Functions Of Parenchyma

1. The main function of parenchyma is storage of food e.g. starch in parenchyma of potato.
2. In fleshy stems and leaves, parenchyma cells serve as water storage tissue e.g. opuntia (cactus)
3. It forms the framework of all the plant organs and tissues by providing rigidity to the plant and thus help to maintain shape and firmness of plant body.
4. It stores waste materials of the plants such as latex, resins, gums, etc.
5. The: intercellular air spaces of parenchyma cells allow gaseous exchange.
6. It provides buoyancy in aquatic plants.
7. If chloroplast is present in parenchyma cells, it performs photosynthesis.
8. It serves as the packing tissue in between the other tissues.
9. It provides mechanical strength to the plants due to its compact arrangement.

***Collenchyma*:-**

It's derived from two words 'colla' and 'enchyma'. Colla means glue and enchyma means - to pour.

General characters

1. It is a living tissue.

2. Cells are thin walled but possess thickenings of cellulose or pectic substances at the corners where a number of cells join together.
3. Cells are compact.
4. Intercellular spaces are absent.
5. It provides flexibility to soft ariel parts of plants so that they can bend without breaking.
6. It may contain a few chloroplasts.

Shape: Collenchyma cells are usually elongated with oblique end walls. In transverse section they appear circular, oval or polygonal.

Distribution: Collenchyma occurs in dicot stem and leaves. It's mainly absent in monocots and in roots.

Functions Of *Collenchyma*

1. It provides mechanical support, protection and elasticity to the plant organs.
2. It manufactures sugar and may store it as starch.
3. It is present at the margins of some leaves and resists tearing effect of wind.
4. It allows easy bending in various parts of the plants without breaking it.

Sclerenchyma:-

It is derived from two words; sclern from sclerous which means hard and enchyma which means in fillings.

General characters:

1. It consists of thick walled dead cells.
2. Those cells have hard and extremely thick cell wall due to uniform deposition of lignin (a complex organic molecule composed of phenyl propanoid units associated with cellulose).
3. Lignin deposition is so thick that the cell wall becomes strong, rigid and impermeable to water.
4. The cell lumen becomes very narrower rarely absent.'
5. Cells are closely packed without intercellular spaces.
6. Cells are cemented with the help of middle lamella [a wall that lies between the adjacent cells].

Shape:- Cells appear as hexagonal net in transverse section.

Types: Sclerenchyma is of two types:
1. Fibres
2. Sclereids

1. *Fibres*:-

These are long, elongated cells with pointed ends. These cells vary in length from 1mm to 550.mm in different plants. The fibres are usually clustered into strands and look polygonal.

2. *Sclereids*:

These are short and possess extremely thick lignified walls. They vary greatly in their shape and size. They may be spherical, oval, cylindrical, dumble shaped or stellate.

Distribution: Sclerenchyma tissue mostly occurs in xylem and phloem, hard seed coats and husk of coconut.

Functions:
1. The main function of Sclerenchyma is to give mechanical support to the plants.
2. It provides a protective covering around seed and nut.
3. Sclerenchyma fibres in plants like jute, coconut etc are commercially exploited.

Complex Permanent Tissues: A complex permanent tissue may be defined as a group of more than one type of cells having a common origin and working together as a unit to perform a common function. The complex tissues are mainly concerned with the transportation of water, minerals and food materials. The important complex tissues in plants are:
1. Xylem or wood
2. Phloem or Bast

Both xylem and phloem are together called as vascular tissues or vascular bundles or conducting tissues.

1. Xylem:-

It is derived from Greek word 'xylos' which means 'wood'. It was first of all seen by a biologist Nageli in 1858.

It's a chief conducting tissue responsible for conduction of water and minerals. This tissue is composed of four kinds of cells.
1. Tracheids

2. Vessels
3. Xylem parenchyma
4. Xylem fibres

1. *Tracheids*:

These are elongated, tube like dead cells with oblique end walls. The end walls remain intact and possess pits, since tracheids do not have open ends, so water has to pass through pits. These usually appear polygonal. The walls are hard and lignified.

2. *Xylem vessels or Trachea*:

The cells of vessels are placed one upon the other and their end walls are either absent or possess perforations. They form long tubes or channels for conduction of water and minerals. Tracheids and vessels are meant for conduction of sap, so they are also called as tracheary elements.

3. *Xylem parenchyma:*

These are living parenchymatous cells present in the xylem. They help in lateral conduction of organic solutes and storage of food reserves.

4. *Xylem fibres:* These are lignified fibres present in the xylem which provide mechanical strength to the plant body.

Functions of xylem:

1. Xylem is a major conducting tissue in plants. It serves in the upward movement of water and mineral salts from roots to different parts of the plants.
2. It gives mechanical strength to the plant body.

2. Phloem (bast):-

It's derived from a Greek word 'phlois' which means inner bark. It was first of all used by Nageli in 1858. Phloem is the chief food conducting tissue of the plants. Phloem is composed of four elements.

1) Sieve tubes
2) Companion cells
3) Phloem parenchyma
4) Phloem fibres

1) Sieve tubes: These are long tubular structures composed of elongated sieve tube elements placed one above the other forming a continuous tube. The end walls of sieve tube elements are called sieve plates which are

perforated by numerous pores. Each mature sieve tube element has thin or thick cellulose wall. Cytoplasm occurs in the form of thin lining enclosing a big central vacuole. Nucleus, plastids, endoplasmic reticulum, etc are absent.

2. *Companion cells*: These are living cells which are always associated with sieve tubes. Each companion cell is living with thin cellulose walls. It possesses nucleus, mitochondria, ER, etc. The common wall between sieve tube and companion cell shows the presence of pits.

3. *Phloem parenchyma:* These are the living parenchymatous cells present in the phloem. They store food, raisins, latex, etc. These cells help in slow conduction of food especially to the sides.

4. *Phloem fibres:-* These are the dead sclerenchymatous fibres present in the phloem. They occur in sheets or cylinders. They provide mechanical strength to the plants.

Functions of phloem:

1. The main function of phloem is translocation of organic solutes from leaves to the storage organs
2. It provides mechanical support to the plant body.

Animal Tissues:

The body of animals is made up of different types of tissues which perform specific functions. On the basis of function they perform, animal tissues can be broadly classified into following types:

1. Epithelial tissue
2. Muscular tissue
3. Connective tissue
4. Nervous tissue

Epithelial tissue

General characters:

1. Epithelial tissue or epithelium is a simplest kind of animal tissue that occurs as a protective covering.
2. It consists of one or more layers of cells.
3. The cells are closely packed.
4. Intercellular spaces may or may not be present.
5. Cells are held together by intercellular junctions.
6. The epithelial tissue rests on a thin, non-cellular basement membrane, (a membrane that doesn't contain cells and consists of glyco-proteins and collagen fibres).
7. Blood and lymph vessels are absent. However, nerve cells are present.
8. The blood vessels lie in the connective tissue across the basement membrane.

Occurrence: It is found on the external surface of the body, internal organs (or viscera), lining of the cavities.

Functions:

1. It covers the body surface as an outer layer of skin.
2. It provides protection to the underlying tissues from mechanical injury, drying up, entry of germs.
3. It forms inner lining of mouth, elementary canal and other internal organs and protects these organs.
4. Epithelial line of intestines absorbs water and digested food.
5. It helps in the elimination of waste products.

6. Epithelial lining of the cavities give rise to glands that provide secretion such as mucus, etc.

Types of Epithelium:

Based on the shape of the cells, epithelial tissue is classified as follows:

1) Squamous epithelium.
2) Cuboidal epithelium
3) Columnar epithelium
4) Ciliated epithelium
5) Glandular epithelium
6) Sensory epithelium

1. Squamous epithelium:

This epithelium consists of thin, flat irregular shaped cells which fit together closely. It is of two types.

a) Simple squamous epithelium
b) Stratified squamous epithelium

a) *Simple squamous epithelium:* The cells in this epithelium are extremely thin and flat and are arranged edge to edge forming a delicate lining or covering. So, it is also called as pavement epithelium.

Occurrence: It lines the blood vessels, urinary tubules and alveoli of the lungs.

b) Stratified squamous epithelium: The cells in this epithelium are arranged in many layers to prevent wear and tear.

Occurrence: It forms the epidermis of the skin. It also lines buccal cavity (mouth cavity), pharynx, oesophagus, anal canal, vagina and lower part of urethra.

Functions:

1. It provides protection to the underlying parts against injury and entry of germs.
2. It helps in excretion, gas exchange, etc.

2) Cuboidal epithelium: This epithelium consists of cube like cells which are about as tall as wide.

Occurrence:

1) It lines the salivary ducts, pancreatic ducts, sweat glands, etc.
2) It also covers the ovaries and lines sperm producing tubules.

Function

It helps in protection, secretion, absorption, excretion and gamete formation.

3) Columnar epithelium: This epithelium consists of tall or pillar like cells that are much taller than wide. The nuclei are generally elongated.

Occurrence

1) It lines the stomach, intestine and gallbladder.
2) It also lines mammary gland ducts and parts of urethra. *Functions*:

It helps in protection, absorption and secretion.

4) Ciliated epithelium:

Structure: This epithelium consists of cuboidal or columnar cells that bear cilia on their free surfaces.

Occurrence: Cuboidal ciliated epithelium lines certain parts of urinary tubules and sperm ducts. Columnar ciliated epithelium lines nasal passage, oviducts, bronchioles and ventricles of brain.

Functions:

It helps in the movement of mucus, eggs, urine, sperms and ceribo spinal fluid.

5) Glandular epithelium:

Structure:- This epithelium consists of columnar cells modified to secrete chemicals or juices.

Occurrence: It lines the glands such as gastric glands, pancreatic glands, intestinal glands, etc.

Functions: It helps in secretion of juices and chemicals.

6) *Sensory epithelium*:

In some cases, the epithelial cells become modified to receive external stimuli. Such sensory cells have nerves so that they can perceive various stimuli.

Occurrence: It is found in nasal passage, taste buds, retina of eyes, etc.

Muscular Tissue:

Muscular tissue of the body consists of long, narrow muscle cells. These cells are elongated in structure and are therefore called as muscle fibres or myocytes. These myocytes inturn contain many chains of myofibrils. Myofibrils are composed of actin and myosin filaments repeated in units called sarcomere. This sarcomere is responsible for striated appearance of

muscle fibres. A muscle fibre may contain one or more nuclei. Muscle cells are arranged in parallel manner and contract in a definite direction which causes movement of body parts. These movements are brought about by contraction and relaxation of contractile proteins (actin and myosin) present in the muscle cells.

Types of Muscular Tissue:

There are three types of muscular tissue:

1) Striated muscles
2) Unstriated muscles
3) Cardiac muscles

Striated muscle *(skeletal muscle or voluntary muscle)*

Characteristics

1) The striated muscles form more than 80% of the mass of soft tissues in a body.
2) They are attached to bones by tendons and help in the movement of external body parts.
3) The striated muscles consist of long, narrow, cylindrical, unbranched fibres with blunt ends.
4) Each fibre is enclosed in a thin, plasma membrane called sarcolemma.
5) The cell contains many elongated, flattened nuclei located towards the sarcolemma.
6) The multi-nucleate condition of the fibres results from cell fusion.

Occurrence:

1) These are found in the body wall and the limbs.
2) They also occur in tongue, pharynx and beginning of oesophagus.

Functions:

1. They help in the movement of body parts and locomotion.
2. They also help in several voluntary movements of the body.

Q) Why are striated muscles called as skeletal, voluntary and striated muscles?

Ans. Striated muscles are called as skeletal muscles because they are

attached to bones and help in movement of body parts. They are also known as voluntary muscles because they are under our control. They are known as striated muscles because they contain dark and light bands.

Unstriated muscle:

Characteristics:

1. These are called smooth or unstriated muscles because they do not show any strips or striations across the muscle fibres.
2. Each cell is long, narrow, spindle-shaped with pointed ends and has only one nucleus situated in the centre.
3. These fibres are generally shorter than the striated muscle fibres.

Occurrence:

1. These occur within the walls of tubular, internal organs (visceral organs) except heart. e.g. Alimentary canal, Genital tract, blood vessels, etc.
2. They also occur in the iris and ciliary body of the eye and dermis of skin.

Functions:

1. Smooth muscles are called involuntary muscles.
2. Their contractions are rythmic.
3. These muscles contract slowly but can remain contracted for a long period of time.
4. Rythmic contractions of these muscles in the walls of tubular organs results in the rhythmic progressive wave of muscular contraction and relaxtion. (peristalisis).
5. These movements occur in gastro-intestinal tract and male genital tract.
6. In some organs, the smooth muscles contract throughout the organ as a single unit and produce extrusive movements as in urinary bladder, gall-bladder, ureters and uterus.

Cardiac muscles:

Characteristics:

1. The cardiac muscle consists of short, cylindrical fibres which are branched and joined to form a network.
2. Each fibre or cell contains one or two nuclei situated in the centre.
3. Intercalated discs occur between the ends of fibres.

4. The cell show light striations.
5. These are involuntary muscles.

Occurrence:

Cardiac muscles are confined to the wall of heart, pulmonary vein and superior venacava.

Functions:

These contract and relax rapidly and continuously with a rhythm.

Nervous tissue:

The nervous tissue contains densely packed nerve cells, called neurons (Greek neuron- nerve). It is present in the brain, spinal cord and nerves. The neurons are specialized for conduction of nerve impulses.

They receive stimuli from within or outside the body and conduct impulses (signals) which travel from one neuron to another. Each neuron is composed of following three parts:

i) Cyton ii) Dendrites iii) Axon

i) Cyton or cell body or soma: The cell body of neuron is called cyton or soma. It is a broad, rounded, pyriform (ear shaped) or stellate part of neuron. It has cytoplasm called neuroplasm and relatively large, spherical nucleus. It also contains nissll granules.

Function:

It receives nerve impulses from dendrites and transmits them to axon.

ii) Dendrites (singular Dendron):

It is a short, tapering, much branched protoplasmic processes stretching out from cell body.

Function:

It conducts the nerve impulses towards the cell body.

iii) *Axon*:

It is single, very long, cylindrical protoplasmic process of uniform diameter arising from cell body. At its terminal end, axon is highly branched. The terminal branches are called terminal arborizations. At their ends are swollen structures called synaptic knobs or bouton that have neuro transmitter called acetycholine.

Axon is covered with one or two sheaths (coverings). The cell membrane of axon is called axolema and its cytoplasm is called axoplasm. The single

sheath present over the axon is called neurilemma. It may have an additional insulating and protective sheath of myelin around it. It is present between neurilemma and axolemma. Axons having myelin sheaths are termed myelinated nerve fibres and those without this sheath are termed non-myelinated nerve fibres. At intervals, myelinated nerve fibres possess unmyelinated areas called nodes of ranvier.

Function: Axons carry impulses away from the cell body to another neuron.

Connective tissue:

General characters:

1. The cells of connective tissue are living.
2. These cells remain separated from each other.
3. The space between the cells is filled with non-living, soft, gel like matrix or medium.

4. Matrix may be fibrous in nature and composed of complex carbohydrates linked to proteins. The fibres present in it are:-

1. White collagen fibres.
2. Yellow elastin fibres.
3. Reticular Reticulin fibres, and complex carbohydrates present in it are GAG glucose amino glycans or muco polysaccherides.
4. Matrix may be solid as in case of bones and cartilages and fluid as in case of blood.

Functions:

1. It serves the function of binding and joining one tissue to other i.e. connecting bones to each other, muscles to bones, etc.
2. It forms a supporting framework of bones and cartilages for the body.
3. It forms a protective sheath and packing material around various organs separating them so'that they do not interfere in each other's activities, carrying material from one part of the body to another.

Connective Tissue:

Types:

In animals there are five types of connective tissue:

1) Areolar tissue
2) Dense regular connective tissue
3) Adipose tissue
4) Skeletal tissue
5) Fluid connective tissue

1) *Areolar tissue*:

It is also called as loose connective tissue. It is a loose and cellular connective tissue. It is most widely distributed in the body. It consists of transparent, jelly like sticky matrix containing numerous fibres and cells and mucin. Its matrix consists of two kinds of fibres.

a) *White collagen fibres*: They are made up of a protein, collagen which changes into gelatin on boiling in water.

b) Yellow elastic fibres: They are made up of a protein elastin. Collagen fibres provide flexibility and strength and elastic fibres provide elasticity. Several kinds of irregular cells for example fibroblasts and macrophages are present in it.

Occurence:

It is simple and most widely distributed connective tissue. It joins skin to muscles, fills spaces inside organs and is found around muscles, blood vessels and nerves.

Functions:

(i) It is a supporting and packing tissue between organs lying in the body cavity. Matrix of this tissue is important in diffusion of oxygen and nutrients from small blood vessels. (ii) It helps in repair of tissues after an injury.

(iii) It fixes skin to underlying muscles.

2) Dense regular connective tissue:

It is a fibrous connective tissue. It is characterised by ordered and densely packed collection of fibres and cells. Fibres are loose and very elastic in nature. It is the principal component of tendons and ligaments.

1. *Tendons*: They are cord like, strong, inelastic structures that joins muscles to bones. A tendon is a bundle of white collagen fibres bound together by aerolar tissue. It has great strength but its flexibility is limited.

2. *Ligaments*: They are elastic structures which connect bones to bones. A ligament is highly elastic and has great strength but contains very little matrix. In ligament, some elastic and many collagen fibres are bound together by areolar connective tissue. Fibroblasts are irregularly arranged.

3) *Adipose tissue*:-

It is an aggregation of fat cells or adipocytes. Each fat cell is rounded or oval and contains a large droplet of fat that almost fills it. The fat cells are arranged in lobules separated by partitions of collagen and elastin fibres. These partitions carry blood vessels.

Occurence:

It is abundant below the skin, between the internal organs for example around the kidneys.

Functions:

1. It serves as a fat reservoir.
2. It provides shape to the limbs and the body.
3. It keeps visceral organs in position. It forms shock absorbing cushions around kidneys and eyeballs.
4. It acts as an insulator.

4) *Skeletal Tissue*:

The skeletal or supporting tissue includes cartilage and bone which form the endoskeleton of vertebrate body.

1. *Cartilage*:

It is a specialised connective tissue which is compact and less vascular. It has widely spaced cells. Its matrix is composed of proteins and is slightly hardened by calcium salts. Its matrix is produced and maintained by chondrocytes. Matrix is solid, cheese like and firm but also somewhat elastic. This accounts for its flexible nature. Matrix of cartilage have a delicate network of collagen fibres and living cells, chondrocytes. Chondrocytes are present in fluid filled spaces known as lacunae. Blood vessels are absent in matrix. Chondrocytes help in internal growth of cartilage by multiplying. Thus cartilage is capable of continued and rapid growth.

Occurence:

It is located in ear pinna, nose tip, epiglottis, intervertebral discs, end of long bones, lower ends of ribs and rings of trachea.

Functions:

It provides support and flexibility to the body parts. It smoothens surface at joints.

2) *Bone*

Nature:- Bone is a very strong and non-flexible tissue. Like cartilage, bone is a specialised connective tissue. It is porous, highly vascular, mineralised, hard and rigid. Its matrix is made up of proteins e.g. osteonectin, osteocalcin, proteoglycan and collagen). Matrix of bone is heavily coated with salts of calciurn and magnesium such as phosphates and carbonates of calcium and magnesium (e.g.
Hydroxyapatite). These minerals are responsible for the hardness of the bone. The matrix of bone is in the form of thin concerntric rings, called lamellae. Bone cells, called osteoblasts or osteocytes, are present between the lamellae in fluid-filled spaces called lacunae. All lacunae of the bone communicate with each other by network of fine canals, called canaliculi. Each canaliculus is filled with delicate
cytoplasmic process of the bone cell. Through canalculi each bone cell of each lacuna receives food and oxygen and eliminates waste.

Functions:-Bone forms endoskeleton of human beings and other vertebrates except the sharks. It serves the following
Functions:

1. It provides shape to the body.
2. It provides skeletal support to body.
3. It protects vital body organs such as brain, lungs, etc.
4. It serves as storage site of calcium and phosphate.
5. It anchors the muscles.

Fluid Connective Tissue (Vascular Tissue):

It links the different parts of the body and maintains continuity in the body. It includes blood and lymph.

Blood:- It a fluid connective tissue. It is reddish coloured due to presence of a pigment called as haemoglobin. This blood carries various functions in our body.

i) Circulation of blood is responsible for transportation of soluble digested food from small intestines to various parts of body. Blood also carries glucose from liver to muscles,
ii) Blood carries soluble excretory materials such as urea to organs of excretion.
iii) Blood carries hormones from endocrine glands to target parts
iv) Circulation of blood helps to maintain constant body temperature by

distributing excessive heat from deeply seated organs.

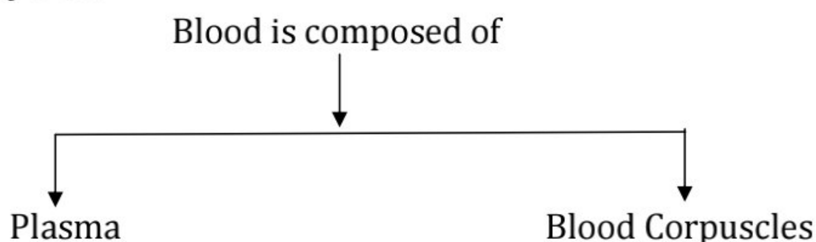
v) Blood transports O_2 from lungs to all parts of body.

vi) Blood carries CO_2 produced by the tissues to the lungs for breathing out.

vii) WBC of blood acts as soldiers of body by killing bacteria and other germs.

viii) It acts as a buffer and maintains a constant pH which maintains the concentration of solute potential of blood i.e. electrolytes.

Composition of blood



Plasma:-It is liquid part of blood in which different blood cells are present. It is straw coloured or can be colourless. It contains major portion of water (90%) and also (10%) of organic / inorganic substances. The different organic substances that are present in it are urea, amino acids, proteins, hormones and the different inorganic substance present in it are sulphates, phosphates, magnesium. Besides, the organic and inorganic substances, it also contains a blood clotting protein called fibrinogen and also contains Anti-coagulant called heparin. If fibrinogen is removed from blood, it results in the formation of serum in plasma. (Serum- A blood plasma from which blood clotting protein is removed).

Different types of blood cells:

i) RBC ii) WBC

iii) Platelets

RBC's : These are also called erythrocytes. These are small, round, biconcave, disc-like structures that are thinnest at the centre. The real colour of RBC is pale yellow but appear red due to presence of haemoglobin. These are 7-8 um in diameter and are denucleated (to transport more O_2). In males, the number of RBC's is 5.5 m/cm^3 and females 4-4.5m/cm^3. RBC have a life span of 120 days and main constituent of RBC is haemoglobin. Due to less presence of RBC's a disease called anaemia is caused which causes breathlessness. If there is more amount of haemoglobin present in blood, it leads to abnormal growth of RBC and thus leads to cancer called polycythemia. Formation of RBC is called

erythropoiesis and is formed in red bone marrow. These RBC's get degraded in liver. Shrinking of RBC's in liver is called erytopis. The content of haemoglobin:

In males is 15.5 +/- 2.5 gm/decileter

In females it is 14.0 +/- 2.5gm/decileter

In children it is 11.0 +/- 2.5 gm/decileter (4 -12 years).

WBC's:-These are also called leucocytes. These are colourless and amoeboid shaped/ irregular). These are large in size than RBC's and are fewer in number. The number of WBC's in males and females is same 5000mm^3. These are nucleated i.e. they have nucleus. There are various types of WBC's like monocytes. Basophills, neutrophills, eosinophills, lymphocytes. WBC's are of two types: Phagocytes and Immunocytes.

Immunocytes: These produce antibodies and are involved in immune response. They include lymphocytes.

Phagocytes: These are capable of phagocytoses and they carry out the function of body defense by engulfing bacteria and other foreign substances. Phagocytes are of two types:

Granular and agranular.

Granular WBC's: These have granular cytoplasm and lobed nucleus. These are of three types basophills, neutrophills, eosinophills.

Agranular WBC's: These have smooth cytoplasm and lobed nucleus e.g. monocytes, lymphocytes. WBC's don't have a particular life span because they are of different types. So, their life span varies like lymphocytes. They have a life span of almost 3-4 days. They provide immunity to body when foreign material enters our body i.e. antigen and our body responses to it. The WBC's engulf it and form a protein called antibodies. These are also called soldiers of our body.

Most WBC are amoeboid and can throw out pseudopodia by which they can squeeze out through the walls of capillaries into tissues. This process is called diapedesis. If more no. of WBC are present in body it will lead to a disease (cancer) called leukaemia.

If less no. of WBC's is present, it will lead to a.disease called leucopoenia. These are formed in white and yellow bone marrow.

Blood Platelets: These are also called thrombocytes. These are small, spherical structures numbering about 4,00,000/mm^3 . These have life span of 2-3 days and are denucleated. It contains a blood clotting protein called thrombin. The function of B.P. is to form a solid plug at the time of injury

which prevents further blood loss.

Lymphatic system:

Lymph: It is light yellow colour, mobile, fluid connective tissue which drains into lymphatic capillaries from inter cellular spaces. Its composition is similar to that of blood except that RBC's and some blood proteins are absent in it. WBC's are found in abundance.

Functions of Lymph

1) Lymph absorbs some of the fluid from digestive tract. It passes proteins to tissues. It carries digested fat.
2) It drains excess fluid from extra cellular spaces back in the blood.
3) It protects the body by killing germs.
4) It carries carbon dioxide and nitrogenous waste materials from tissues to blood.

Topic: NATURAL RESOURCES

Introduction

A resource is defined as: Any means of attaining given ends or a source of supply or -support generally held in reserve. Naturally resource includes total natural environment that is the entire surface layer of earth. All parts of earth's surface are of some use to man as they contribute to the production of necessities and comforts of mankind.

Natural Resources



Inexhaustible
Exhaustible

Resources present in unlimited amount. Resources are present in limited amount

Resources are not likely to be perish by Resources are likely to be perish by

human activity or their use. the continuous use of human beings.

For example: Air, water and solar radiation.



Renewable Resources Non-renewable Resources

Can replenish themselves by quick recycling Cannot replenish themselves by

And replacement within a reasonable time

Recycling and replacement

Can last for ever with limited use Will finally get exhausted

Both living and non-living resources Only non-living resources

Availability can be enhanced by Increased consumption will lead to exhaustion

increasing replenishment

For example: Soil, forests, wildlife For example: Minerals and fossil fuels like
coal etc.

Resources On earth

Biosphere is the life supporting system of earth's surface extending from a few miles into the atmosphere to the deep-sea vents of oceans. Resources on earth are land, water and air. Natural resources are components of atmosphere, hydrosphere and lithosphere. The physical portion of biosphere is divided into three groups:

1) *Lithosphere*:- It includes the solid components of the earth's crust -soil, rock, minerals and other masses. Only the outer layer

of earth's crust called soil contains the living- organisms and forms part of biosphere.

2) *Hydrosphere*:- It includes all aquatic components- the ponds, rivers, lakes and the seas. .Water covers about 75 percent of total earth's surface.

3) *Atmosphere*:- The atmosphere is the gaseous cover around the hydrosphere and lithosphere like a blanket.

Atmosphere extends to several kilometers in height from the surface of earth. It is distinguished into four parts i.e. troposphere, stratosphere, ozonosphere and ionosphere.

The Breath Of Life : Air

Air is the mixture of gases like nitrogen, oxygen, carbon dioxide and water vapour. Gaseous envelope surrounding the earth is called atmosphere (air).

1. Earth's surface is dominated by nitrogen and oxygen contributing 78% and 21% respectively. Rest of 1% is contributed by argon and CO_2 0.03% along with hydrogen, helium, neon, krypton and many other gases in minute quantities.

2. Small amount of water vapour, dust, slats, smoke is also found.

Rain



The warm, moist and rising air cools and forms clouds in the sky. This happens due to heating of water bodies during day time which get mixed with atmosphere. As air rises, it expands and cools. Cool air in the atmosphere sinks towards the ground. Due to cooling water vapour present in air take the shape of small droplets. When a particle like dust acts as a nucleus, process of condensation is facilitated. These tiny droplets becoming bigger and bigger due to condensation. When they become heavy, they fall down in the form of rain.

Air Pollution

Pollution refers to any undesirable change in physical, chemical and biological properties of our environment i.e. air, water and land which cause harmful effects to various forms of life and property.

A pollutant is a substance (e.g. dust and smoke), chemical (e.g. SO_2) or factor (e.g. heat, noise) that

on release to environment has a bad effect on human interests. Pollutant can be defined as constituent in wrong amount at a wrong place or wrong time.



Air pollution is the occurrence of foreign particles or gases in the atmosphere which are harmful to man, vegetation, animals and buildings.

Effects Of Air Pollution

1) Combustion of fossil fuels increases the amount of suspended particles in air. These particles may be unburnt carbon particles or substances like hydrocarbons. Lead is known to damage kidney, liver, blood formation. It may lead to anaemia, muscle paralysis, hypertension, etc. Hydrocarbons cause eye irritation, sneezing, drowsiness, etc. Suspended particulate matter (SPM) like dust causes ailments like asthama, bronchitis, etc. Regular breathing of polluted air may become the cause of allergies, cancer and heart disease.

Fossil fuels like coal and petroleum bear little quantity of nitrogen and sulphur. Nitrogen and sulphur present in these fuels when burnt release oxides of nitrogen and sulphur. Such gases show following effects:

a) On inhalation, such gases become dangerous.

b) These gases when dissolved in rain produce acid rain.

2) Coal dust etc. are a source of nuisance for households and impart a dirty look.

3) Dust, smoke and other SPM reduce the visibility. Flashy also affects visibility. It also leads to greenhouse effect and depletion of ozone layer. Thinning of ozone shield will allow shorter and high energetic UV radiations in earth's atmosphere and cause extensive damage to plants as well as animals.

Water: A wonder Liquid

Water is renewable resource, water is vital to life since for all physiological activities of plants and animals, it is essential. Water is mainly present in two forms, i.e.

a) Surface water

b) Ground water.

Type of water resources

Water resources can be classified into two types i.e.

i) Fresh water resources

ii) Salt water resources.

i) Fresh water resources:- These range from ponds to lakes and large rivers. Fresh water is obtained by following three types of natural resources:

1. Rain water

2. Surface water

3. Ground water

Water Pollution

Water pollution can be defined as the addition of some substances, which degrades the quality of water so that either it becomes health hazard or unfit for use.

Ground water pollution is mainly caused by:

a) Septic tanks.

b) Industries like textile, chemical and tanneries.

c) Deep well- injections and mining activities.

Surface water like streams, lake, etc. contains small amount of suspended particles and many micro-organisms. Water used for household, agriculture and industrial purposes when discharged after use is polluted with soluble, insoluble matter and even pathogens.

The- domestic effluents include human and animal excreta, detergents, plenty of organic matter in the form of food residue. Industries usually discharge waste water into ponds, lake and rivers. Industrial pollutants are the most hazardous pollutants on land and water. The surface run-off from fields

contains agrochemicals like DDT which are non-degradable.

Effects of water pollution

1. Micro-organisms use oxygen in decomposing of organic wastes causing deoxygenating of water which stimulates algal blooming.

2. Foul smell in water bodies is produced which makes it unfit for human consumption.

3. Organic wastes from a scum and sludge in polluted water which becomes unfit for industrial use.

4. Phosphates of detergents stimulate the algal growth, which is called eutrophication.

5. Compounds like mercury, arsenic and lead are eurotoxin in nature.

6. Pathogen contaminated water is known to be cause a number of diseases like jaundice, cholera, typhoid, dysentery, etc.

7. Aquatic organisms are adapted to survive in a particular range of temperature. Any sudden change in this temperature may effect their breeding and can cause damage to their eggs and larvae.

8. Any change which retards the dissolved oxygen in water bodies.



Mineral Riches In Soil

Lithosphere is the main life supporting system. Top layer of earth is called soil. It is the main natural resource essential for survival and development. More than four fifth of land is covered by soil. Top soil differs widely in colour according to the types of minerals and humus components contained in them.

Structure and formation

Soil is formed due to interaction between weathering of rocks, rain, wind, temperature (physical weathering) with plants, animals and microbes (biological weathering). Pulverisation of rocks by

chemical action in wet weather like hydration, oxidation, reduction, carbonation and solubilisation is called chemical weathering. It is capable of supporting life. Soil contains:

(a) Inorganic constituents of parent rocks

(b) Organic products of living organisms

(c) Living organisms including micro-organisms

(d) Air in the pores.

Soil is formed by combined action of climatic factors such as temperature, rainfall, light etc. and biotic factors such plants and microbes on earth's crust.

There are four important components of soil. They are:

i) Mineral matter 50-60%

ii) Organic matter

a) Living organisms

b) Micro-organisms 10%

iii) Soil water 25-35%

iv) Soil air 15-25%

Soil Pollution

Soil pollution can be defined as decrease in soil fertility because of addition of some foreign elements. Soil is polluted with dumping of solid wastes generated in house hold and manufacturing units. Domestic wastes include kitchen garbage, broken bottles, cloth rags, ash, etc. Industrial wastes include flash, metal scraps, dyes, plastics, etc. Agricultural chemical and fertilizers are also the cause of land pollution. The dumping of human and fertilizers are also the cause of land pollution. The dumping of human excreta and waste from cow-sheds and slaughter houses befouls the land. Most important causative pollutant of soil is plastics.

Effects of soil pollution

1. The industrial pollutants increase the toxicity levels of the soil.

2. Soil pollution due to domestic sewage may cause diseases like giardiasis, tetanus, etc. in human beings.

3. Land pollution may also cause several plant diseases.

4. Weedicides act as metabolic inhibitors or reduce the plant yield.

5. Mine dust causes many types of deformities in animals and human beings. It also destroys the vegetation of that area.

6. Excess of fluorides in land cause fluorosis.

Soil Erosion

Soil erosion is the movement of top soil from one place to another. Removal of top soil leads to loss

in fertility.

Soil erosion occurs mainly due to winds or water flow. Overgrazing and mining are responsible for

loss of soil. Roots of plants help in binding the soil, thus helping in checking of soil erosion. Plants reduce the wind velocity considerably and transport of lifted sand is checked by trees.



Large scale deforestation is not causing only loss of biodiversity but also leading to soil erosion.

Methods of preventing soil erosion

OR

Prevention of loss of topsoil

1. Deforestation should be checked.
2. Afforestation (plantation of trees) should be carried out on large scale. Trees act as wind breaks.
3. Boundaries of fields should be planted with trees in two to three rows.
4. Practices like crop-rotation should be done.
5. Strip cropping should be done on slopping areas of the hill.
6. Suitable irrigation arrangement and drainage system should be made in fields.
7. Grazing should be limited to particular seasons and limited number of animals.
8. Slopes at hills should be divided into number of flate fields to slow down the flowing water by formation of terraces.

Biochemical Cycles

Biochemical cycles are the cyclic pathways through which chemical elements move from environment to organisms and back to-the environment. Such cycling is essential as the earth and its environment, with reference to these elements, are considered as closed system and there is no inflow of such elements from outside the earth and their amounts are limited.

1. Water Cycle

Two types of water cycles:

a) Global water cycle:- It does not involve living organisms and involves the interchange of water between the earth's surface and the atmosphere via the processes of precipitation and evaporation. Ocean is the biggest store house of water. Evaporation involves the conversion of liquid and solid forms of water into vapour and later form the clouds. Precipitation involves the rainfall, hail, snow, etc. Energy for global water cycle is provided by sunlight.

b) *Biological water cycle*:- It is the interchange of water between abiotic and biotic components of environment e.g. the plants absorb water from water bodies and soil while lose most of water by the process of transpiration. Animals consume water from water bodies or the food ingested, while release the water via the processes of respiration and excretion.

1. Nitrogen Cycle

Significance of nitrogen:- Nitrogen is essential component of amino acids, proteins, enzymes and nucleic acids of the protoplasm.

Source of nitrogen:- Reservoir pool of nitrogen is atmosphere which contains about 78.62% of nitrogen in gaseous state. But it cannot be used directly and is changed into nitrites and nitrates and then utilized.

Four steps of nitrogen cycle

i) Nitrogen fixation:- It involves the conversion of free diatomic nitrogen (N_2) into nitrites and nitrates. It occurs in three ways:

a) Atmospheric nitrogen fixation in the presence of photochemical and electrochemical reactions induced by thundering and lightening.

b) Industrial nitrogen fixation in the industries at high temperature and high pressure.

Biological nitrogen fixation in the presence of certain living organisms e.g.

- Rhizobium bacterium in the root nodules of legumes.
- Azotobacter bacterium in the soil.

- Anabaena (blue green alga) in water in the paddy fields.
- Azospirillum bacterium in loose association with the roots of maize, sorghum, etc.

ii) *Ammonification*:- It involves the decomposition of proteins of dead plants and animals into ammonia in the presence of ammonifying bacteria like Bacillus ramosuns.

iii) *Nitrification*:- It involves the oxidation of ammonia to nitrites (NO_2) and nitrates (NO_2) the presence of nitrifying bacteria like Nitrosomonas (Ammonia to nitrite), Nitrobates (Nitrite to nitrate), etc. Plants absorb the nitrites and nitrates from the soil through their roots and convert them into organic compounds (e.g. proteins) of protoplasm by the process of nitrogen assimilation.

iv) *Denitrification*:- It involves reduction of ammonium compounds, nitrites and nitrates into molecular nitrogen in the presence of denitrifying bacteria like Thiobacillus denitrificans.

2. Carbon Cycle

Significance:- carbon is the basic component of all the organic compounds like carbohydrate proteins, lipids, enzymes and nucleic acids of the protoplasm. In atmosphere, it is present as carbon dioxide.

CO_2 utilization:- Carbon dioxide is utilized by the photosynthetic organisms like green plants photosynthetic bacteria, diatoms and blue-green algae in the process of by photosynthesis. It occurs in the presence of chlorophyll and radiant energy of sunlight. Glucose synthesized by photosynthesis is used to synthesize other organic compounds.

CO_2 Production

i) CO_2 is released during respiration of producers and consumers.

ii) During decomposition of organic compounds of dead bodies.

iii) During burning of fossil fuels like wood, coal, petroleum, etc.

iv) Volcanic eruptions and hot springs.

v) During weathering of rocks by acids produced by micro-organisms and roots of plants.

3. Oxygen Cycle

Oxygen is present in water and forms 21% of air in atmosphere. All living beings need respiration. Oxygen content of atmosphere has remained constant for last several million years. Most of O_2 lost is replenished by photosynthesis. During photosynthesis CO_2 is used by plants to form food along with

release of oxygen. The oxides can be reduced chemically and biologically to produce oxygen. Microbial oxidation can also occur. Due to burning of materials oxygen form carbon dioxide. When oxygen combines with nitrogen, it forms oxides of nitrogen, amino acids, proteins etc. These compounds breakdown release the oxygen in atmosphere.

Green House Effect

The average global temperature is 15°C which is maintained due to presence of gases like carbon dioxide, methane, water vapour, chlorofluorocarbons. etc. These gases are collectively called heat trapping or greenhouse gases (GHGs). Earth temperature is maintained by reradiated infra (heat) radiations by these GHGs which prevent heat from escaping to outer space. This effect is called greenhouse effect.

Global Warming

Global Warming is the increase in a average global temperature due to increase in amount of Green House Gases in earth's atmosphere.

Consequences of Global warming

i) *Rise in sea level*:- Global warming will melt polar ice caps. If all the ice on earth melts, about 200 feet of water would be added to surface of all

oceans. Thus low lying coastal cities like Shanghai, Kolkata, Bangkok, Dhaka, Venice, etc. will be inundated.

ii) *Increase in global temperature:-* If present input trend of Green House Gases continued, the earth's global temperature will rise.

iii) *Effect on agriculture:-* Grain production will be reduced. India's annual monsoon rains may even cease together. One third of global forest might be swept away. Desserts are likely to increase.

iv) Chances of hurricanes, cyclones and floods will be more.

v) Increased temperature and humidity caused by global warming will lead to spread of diseases like malaria, filariasis etc. due to spread of vectors. Incidences of respiratory and skin diseases are likely to increase.

Ozone Layer Depletion And Its ill Effects

Stratospheric Ozone Layer:- Between 20 and 26km above the sea level and situated in the stratosphere, there is an ozone layer and is called ozonosphere. This layer is established due to an equilibrium between photo-dissociation of ozone by UV-radiations and regeneration of ozone. The thickness of this ozonosphere averages 0.29cm above the equator but

may exceed 0.40cm above the poles during the winter months.

Significance of Stratospheric ozone layer:- The ozone layer acts as an ozone shield and absorbs the harmful UV-radiations of the sunlight so protects the earth's biota from the harmful effects of strong UV-radiations. So this layer is very important for the survival and existence of life on earth.

Causes of thinning of ozone layer: The decline in ozone-layer thickness is called ozone hole. Ozone hole is largest over Antarctica. Main chemicals to be responsible for destruction of ozone-layer are: Chlorofluorocarbons (CFCs), halons (used in fire extinguishers), methane and nitrous oxide. Out of these, most damaging is the effect of CFCs which are a group of synthetic chemicals and are used as coolants in refrigerators and air conditioners; as cleaning solvents, propellants and sterilant etc. These CFCs produce "active chlorine" (Cl and ClO radicals) in the presence of UV-radiations. These active chlorine radicals catalytically destroy ozone and convert it into oxygen.

Ill-effects of ozone depletion:- The thinning of ozone layer results in an increase in the UV radiations reaching the earth's surface. It is estimated that a 5% loss of ozone results in a 10% increase in UV-radiations. These UV-radiations cause:

i) Increased incidence of cataract and skin cancer.

ii) Decrease in the functioning of immune system due to killing of melanin-producing cells of the skin.

iii) Inhibit photosynthesis in most of phytoplankton's so adversely affecting the food chains of aquatic ecosystems.

iv) Damage of nuclei acids of the living organisms.

Ql. *How is our atmosphere different from the atmosphere of Venus & Mars?*

Ans. The multi layered gaseous blanket surrounding the earth is called atmosphere. Atmosphere filters sunlight reaching the earth, affect climate & is a reservoir of several elements which are essential for life.The atmosphere of earth is a mixture of many gases like nitrogen, oxygen, carbon dioxide & water vapour. But in case of Venus & Mars, the major component of atmosphere is CO_2. It constitutes upto 95-97 % of atmosphere on Venus & Mars.

Q2. How does atmosphere act as a blanket?

Ans. The atmosphere act as a blanket as:

i) It keeps the average temperature of earth steady during the day as it reflects the infra red rays back which otherwise can increase the temperature of earth .

ii) During night, it slows down the escape of heat into the outer space.

Q3. What causes winds?

Ans. During the day, the temperature of earth increases due to which the air above the land also gets heated up. As we know that hot air is lighter & has a property to rise up. This heated air also rises up in the atmosphere & displaces the cold air from that region of atmosphere (over the sea) creating a region of low pressure. This displacement of air from one region to the other creates wind.

Q4) How are clouds formed?

Ans. During the day, when water bodies are heated, a large amount of water evaporates & goes into the air. Furthermore, some amount of water-vapour is also released into the atmosphere due to various biological activities like respiration, temperature etc. The air gets heated up & rises up carrying water vapour with it. Air expands on rising & than cools which causes the water vapour in the air to condense & form tiny droplets. The water droplets get bigger & from clouds.

Q5) List any three human activities that you think would lead to air pollution.

Ans. An increase in the content of harmful substances like Carbon dioxide, Sulphur dioxide,

Nitrogen dioxide, Hydrocarbons, Smoke, Dust etc. in air is known as air pollution. The three human activities that we think would lead to air pollution are:

1) Deforestation

2) Combustion of fossil fuels like coal, petroleum etc.

3) Smoke from industries.

Q6) Why do organisms need water?

Ans. Organisms need water because:

1) About 10 % of every cell is composed of water.

2) Water is required to carryout a no' of biological-processes like digestion, transportation of nutrients, excretion & so on.

3) Water acts as universal solvent & helps in transportation of substances in dissolved form from one part of the body to the other.

4) Water is also required to carry out a number of domestic activities like cooking, bathing, agriculture (irrigation) etc.

Q7) *Name some human activities which may pollute a water sources.*

Ans. Some human activities responsible for water pollution are:

1) Addition of some undesirable substances in water like polythene bags, fertilizers, pesticides etc.

2) Disposal of domestic wastes into water bodies.

3) Disposal of industrial wastes like mercury salts (used by paper industry) into water bodies.

Q8) How is soil formed?

Ans. Soil is formed by the weathering of the parent rocks by some physical, chemical or biological agents. The temperature, water, ice, gravity, wind, snow, sun etc. are some of the climatic weathering agents. Chemical weathering consists of chemical decomposition of rocks. Decomposition of parent rocks by micro-organisms, plants or animals is called biological weathering of rocks. As a result of weathering, rocks are broken down in small particle, called primary soil which is later converted into mature soil.

Q9) What is soil erosion?

Ans. The removal of top layer of soil by wind & rainfall is called soil-erosion. The top- soil is most valuable natural resource because it takes 100 years for 1 cm of top soil to get formed. Some of the factors responsible for soil erosion are:-

1) *Deforestation & over-grazing*:- Both of these activities leave the top-soil bare of vegetation due to

which binding force between soil particles decrease. The soil, therefore, can't withstand the impact of wind & water & gets washed away easily.

2) *Soil characteristics:* Soil with low water holding capacity is carried away by wind & water easily.

3) *Climatic Factors*: These include humidity , rainfall, temperature, winds.

Q10) What are the methods of preventing soil erosion?

Ans. The methods of preventing soil erosion are:-

1) *Aforestation*: - More & more plants should be grown because the roots of plants bind the soil particles together & prevent them from being carried away by strong winds & water.

2) *Overgrazing* by animals should be checked.

3) *Bunds* should be build to check the flow of water.

4) *Terrace farming* should be done in hilly areas.

5) *Proper leveling* of the land should be done so that water may be drained out easily.

QlI) What are the different states in which water is found during the water cycle?

Ans. During the water cycle, water is found in soil (ice), liquid (water) & gaseous (vapour) states.

Q12) List any three activities which would lead to an increase in the CO_2 content in the air.

Ans. These three activities are:-

1) *Deforestation*: Due to cutting down of trees on large scale, the CO_2 released during respiration by all organisms will remain unused thus leading to increase in the concentration, of CO_2.

2) Burning of fossil fuels like petroleum in automobiles & industries release a large amount CO_2 into the atmosphere.

3) Burning of charcoal & coal for carrying out a no' of domestic activities.

Q13) What are the two forms of O_2 found in atmosphere?

Ans. Molecular oxygen i.e. a diatomic molecule having two oxygen-atoms and Ozone i.e. a triatomic molecule having three oxygen atoms.

Q14) What is green-house effect?

Ans. An increase in the earth's temperature due to an increase in the CO_2 concentration is known as green-house effect. CO_2 in the atmosphere prevents the heat radiations reflected by the earth from escaping into the outer space causing a rise in the temperature of earth

OR

In order to protect the plants from extreme cold, plants are grown in glass buildings called green house. The green house prevents the inner temperature from dropping too low, so that plant may not die of cold. This effect is called green-house effect.

Q#15 *How are living organisms dependent on the soil? Are living organisms in water totally independent of soil as a resource?*

Ans. Almost all living organisms are dependent on plants directly or indirectly because plants are producers in the food chain or we can say that without plants, food chain is incomplete. Since plants grow in the soil, living organisms are dependent on the soil. Furthermore, terrestrial organisms are directly dependent on soil because for them soil acts as a medium for their survival.

Organisms that live in water are not totally independent of soil as a resource because many nutrients present in the soil flow in the water via rain in the water bodies which are necessary for these organisms.

Q16) You have seen weather reports on T.V & in newspapers. How do you think we are able to predict weather?

Ans. Weather can be predicted by studying wind patterns i.e. from where winds will originate & where they will stop. It is the wind patterns that decide the pattern of rainfall. This pattern also shows areas of low pressure & high pressure. In India, rains are mostly brought by South-West or North-East monsoons.

Q17) Why is atmosphere essential for life?

Ans. Atmosphere is essential for life in following ways:-

1) One of the components of atmosphere is O_2 & this O_2 is used by all living organisms in the process of respiration for oxidation of food to release energy.

2) Another component of atmosphere i.e. CO_2 acts as a raw-material for plants in the process of photosynthesis.

3) The ozone-layer of atmosphere acts as a shield & protects the living organisms from the harmful effects of U.V radiations emitted by sun by absorbing them.

4) Atmospheric air regulates the temperature of the earth & keeps it at a level at which life could be sustained.

5) Atmosphere (air) acts as a medium for sound waves to travel from one place to another therefore enable us to communicate.

Q18) Write a note on how forests influence the quality of our, soil & water resources.

Ans. i) Forests play a vital role in the recycling of air. Forests consists of large no' of trees, shrubs & herbs. They take in CO_2 & release O_2 during photosynthesis. This demand is fulfilled by forests.

ii) The roots of trees & plants bind the soil particles firmly. They form a vegetation cover over the fertile top soil. Thus, they prevent the removal of top soil & hence, prevent soil erosion.

iii) Forests give out enormous amount of water in the form of water vapour into the atmosphere through transpiration. This water vapour helps in the formation of clouds which on precipitation cause rain. If forests are cut & not replenished, there will be reduction in the rainfall & hence the water-level of various bodies present on earth will fall.

Q19) What is global warming?

Ans. An increase in the concentration, of CO_2 in the atmosphere is found to increase the temperature of the earth. A subsequent rise in temperature is likely to disturb the earth's delicate thermal balance which may cause several adverse changes in the climate. An increase in earth's temperature would result in the melting of ice capes raising the sea level & causing

flood in the coastal areas. There would be rapid water evaporation causing an increase in the concentration, of water vapour in the atmosphere.



Topic: Why do we Fall ILL

1. *What is health?*

a. According to World Health Organisation (WHO) (1948), health is defined as:

"Health is a state of complete physical, mental and social well being, and not merely an absence of disease or infirmity. Health is a state of body when all the organs and systems are functioning properly and a perfect balance is maintained between the environment and the body." So health has three dimensions:

i) Physical health involves perfect functioning of all the organs and systems of body.

ii) Mental health means a state of harmony and balance between the individual and the surrounding. Individual is free from anxiety and tension,

iii) Social health means a man having good job, a good house, a happy family, good neighbours and understanding friends.

Factors Affecting Health

i) Physical environmental factors like light, temperature, natural disasters like cyclone, flood, soil- type, rainfall etc.
type, rainfall, etc.

ii) Social environmental factors like job conditions, housing conditions, family's atmosphere and relationship between neighbourers and friends.So social equality and harmony are necessary for good health of individuals. Social environment determines our physical environment,

iii) Public cleanliness so as to avoid accumulation of garbage, blocking of drainage, open and stagnant
water, etc. which may increase the chances of poor health,

iv) Supply of balanced diet for good health as it is



essential for the normal body functioning, growth and development of body,

v) Good economic conditions and good purchasing powers increase the chances of good health.

This proves that personal and community issues both play important role in determining individual's health.

Characteristics of Good Health

The important characteristics of a person having good health are:

i) Free from sickness and diseases.

ii) Free from unnecessary anxiety.

iii) Free from social and psychological tensions.

iv) Self confidence.

v) Feeling of joy in living.

vi) Ability to work efficiently and at his best.

Importance of Good Health

Good health is one's real wealth. A healthy person is always cheerful, active, willing worker and energetic. Good health increases one's efficiency for doing work. This contributes to his own progress, the progress of his family, the progress of his community and the progress of nation as a whole.

Disease

(dis = against; ease = comfort)

Any condition which interferes with the normal functioning of the body and impairs the health is called disease. It involves morphological (structural), physiological (functional) or psychological disturbance in some body parts. It may be due to environmental factors or pathogens or genetic anomalies.

Type of Diseases



On the basis of period of their occurrence, the diseases are classified in two categories:

1) Congenital diseases: These are inborn diseases which are present from the birth. These are generally inheritable e.g.

i) Diseases cause by gene-mutations e.g. haemophilia, colour blindness, etc.

ii) Diseases caused by chromosomal mutations e.g. Down's syndrome, Klinefelter's syndrome, etc.

2) Acquired diseases: These occur only after birth and are non-inhertitable. On the basis of their communication, acquired diseases are of two types:

i) Communicable disease and

ii) Non-communicable diseases.

i) *Communicable diseases*: These can be transmitted from an infected person to a healthy person by means of air, water, food, physical contact or vectors. These are caused due to infection and multiplication of some kind of micro-organisms, so are also called infectious diseases. *Classification of communicable diseases*: These can be categorized on two basis:

a) *Causative agent*, and

b) Mode of transmission

a) Depending upon the causative agent, communicable diseases are of six types:

i) *Bacterial* diseases e.g. diphtheria, whooping cough, leprosy, syphilis, tetanus, typhoid,
tuberculosis, cholera, anthrax, etc.

ii) *Viral* disease e.g. dengu, influenza, measles, polio, smallpox, chickenpox, common cold, rabies, Japanese encephalitis, AIDS, etc.

iii) *Protozoan* diseases e.g. malaria, amoebiasis, kala azar, sleeping sickness, etc. iv) Helminth diseases e.g. taeniasis, ascariasis, elephantiasis, trichinosis, liver rot, etc.

v) *Fungal* diseases e.g. ring worm, athlete's foot, etc.

vi) *Rickettsial* diseases e.g, typhus fever, trench fever, Q-fever, Rocky mountain spotted fever, etc.

b) On the basis of their mode of transmission, the communicable diseases are of two type:

i) *Contagious* diseases:- These communicable diseases can spread from an infected person to healthy person by actual contact between them e.g. STDs, smallpox, chickenpox, measles, laprosy, etc.

ii) *Non-contagious* diseases:- These can spread from an infected person to healthy person with food, air or water e.g. taeniasis, ascariasis, cholera, tuberculosis, typhoid etc. or micro¬organisms are injected inside the human body by some carrier or vector hosts e.g. malaria, filariasis, plague, etc.

ii) *Non-communicable or non-infectious diseases*: These do not spread from an infected person to a healthy person. These are of four types on the basis of their causative agents:

1. Deficiency diseases: These occur either due to deficiency of some nutrients in the diet or some hormone e.g., kwashiorkor (protein), diabetes mellitus (insulin), dwarflsm (growth hormone), etc.

2. Degenerative diseases: These occur due to degeneration of certain body tissues e.g. cardiovascular diseases (of heart and blood vessels) and arthritis (of joints).



3. Cancerous diseases: These occur due to uncontrolled growth and divisions of cell in certain body tissues leading to tumour formation.
4. Allergic diseases: These occur due to hypersensitivity of body to certain external agents, called allergens, e.g. asthma, hay fever, etc.

Causes Of Diseases (Etiology)

Any substance which causes a disease by its excess or deficiency or absence, is called a disease agent.

Types of disease agent

Disease agents are of five types:

1. *Biological infectious agents:* These are also called pathogens (Gr. Pathos means disease; genesis means producing). These are those micro-organisms which when successfully infect the human body, multiply and produce toxins which interfere with the normal functioning of the body and cause a disease. These include bacteria, viruses, rickettsias, fungi, protozons, helminthes etc.
2. *Chemical agents* which may be endogenous e.g. urea uric acid, hormones, enzymes etc. or exogenous e.g. pollutants like gases, dust, metals, fumes; and allergens like spores, pollens, etc.
3. *Nutritive agents* e.g. minerals, carbohydrates, proteins, fats, vitamins and water.
4. *Physical agents* e.g. heat (stroke), cold (frost bite), radiations, sound (impaired hearing), etc.

5 *Mechanical agents:* These include injuries, fractures, sprains, dislocations, etc.

Out of these five types of disease agents, biological agents or pathogens; exogenous chemical agents like addictives (e.g. alcohol, tobacco in drugs), pollutants and



allergens; nutritive agents physical agents and mechanical agents are collectively called extrinsic or external factors. On the other hand, endogenous chemical agents and genetic mutations are collectively called intrinsic or internal factors affecting the human health. The diseases caused by the intrinsic factors are called internal factors affecting the human health. The diseases caused by the intrinsic factors are called organic or metabolic diseases and include genetic diseases like haemophilia, sickle-cell anaemia and four types of non-communicable diseases e.g. heart attack, arthritis, diabetes, haemophilia, allergy, etc.

These five types of disease agents are called primary or immediate causes of the diseases, while the chances of diseases are further increased by certain contributory causes like:

i) Lack of good nourishment and poor heredity (second-level cause) which decrease the disease-resistance power of an individual.

ii) Genetic differences between the organisms.

iii) Poverty and lack of public hygiene services (third -level causes) which increase the chances of diseases.

Means Of Spread Of Diseases (Epidemiology)
(Modes Of Transmission)

Communicable diseases are those diseases which can be transmitted from reservoir or source of infection or an infected person to the healthy but susceptible persons. There are two modes of transmission:

i) Direct transmission, and
ii) Indirect transmission.

i) Direct transmission: In this, the pathogens are



transmitted from an infected person to a healthy person directly without an intermediate agent. It occurs in the following ways:

a) *By direct contact with an infected person*: (i.e. hand shake, mouth-to-mouth kissing, etc) e.g. contagious diseases like chickenpox, smallpox, measles, leprosy, ringworm, gonorrhoea, syphilis etc.

b) *Droplet infection* (coughing, sneezing and spitting of infected person) e.g. pneumonia, diphtheria, influenza, tuberculosis, common cold, whooping cough, etc. These are more common in more crowded living conditions.

c) *Contact with soil*. e.g. bacterial cysts of tetanus.

d) *Animal bites* e.g. rabies viruses.

e) *Transplacental transmission*: The viruses of German measles and AIDS and bacteria of syphilis can be transmitted from the maternal blood into foetal blood through placenta.

ii) *Indirect transmission*: When the pathogens can be transmitted from the reservoir of infection to a healthy person through some intermediate agents. It occurs in following ways:-

a) *Vector borne diseases* e.g. malaria (female Anopheles), dengue (Aedes mosquito), cholera, (housefly), sleeping sickness (Trypanosoma), kala-azar (Leishmania) etc.

b) *Vehicle borne*:- Pathogens of cholera, dysentery, typhoid etc. are transmitted by agencies like contaminated food, water etc. Such diseases are more common in areas without safe supplies of drinking water. AIDS is spread by blood of suffering persons or semen donors.

c) *Air borne* e.g. influenza, epidemic typhus.

d) *Formite borne*:- In this, the pathogens are spread

through contaminated articles like handkerchiefs, towels, crockery, etc.

e) *Unclean hands* e.g. Ascariasis (Ascariasis lumbricoides) and Enterobiasis (Enterobius vermicularis).

Sexually- transmitted diseases (STDs) are those diseases which spread by sexual contact from an infected person to another person e.g. bacterial diseases like syphilis and gonorrhea, and viral diseases like AIDS.

Manifestations Of Diseases (Disease Symptoms)

Diseases? are characterized by interference in the normal functioning of the body leading to impairment of health. These diseases show certain abnormal changes in the functioning or the appearance of one or more symptoms of the body, called disease symptoms, like headache, coughing, loose motions, wound with pus, etc.

These disease symptoms are of two types:

1. Organ-specific and tissue-specific manifestations
2. Common manifestations.

1. *Organ-specific and tissue-specific manifestations* depend on the target organ which the microbes target after their entry e.g.

Target organ	Specific manifestation
Lung Liver	Cough, breathlessness, chest pain and may be bloody sputum as in TB and lung cancer. Inflammation of liver cells leading to jaundice characterized by yellowness of skin and eyes as in Hepatitis.
Intestine Nasal	Inflammation of intestinal mucosa leading to acute diarrohoea and



chambers	dehydration as in cholera. Inflammation of nasal mucosa leading to sneezing, bronchitis, coughing, fever, etc. as in influenza.
Brain	Headaches, vomiting, fits or unconsciousness.

2. Common manifestations: These are observed in a number of diseases and generally occur due to activation of immune cells in response to infectious agents. These immune cells either produce antibodies or actually attack and kill the disease causing microbes. This is manifested in the form of inflammation characterized by redness of the infected area, swelling, fever and increase in permeability of the capillaries of that area.

Severity of disease manifestations depends upon the following factors:

1. Number of microbes inside the body so the disease manifestations may be minor and unnoticeable when the number of microbes is very small while these symptoms may be large enough and life threatening when the infection is large.
2. On the tissue or organ which the microbes target e.g. HIV enters in the body through the sexual contact but spreads to lymph nodes through the blood.

Prevention of Diseases (Prophylaxis)

There are two ways of prophylactic measures: A. General prophylactic measures:

i) Air-borne diseases like pneumonia, tuberculosis, influenza, etc. can be prevented by avoiding over crowding and providing hygienic living conditions,

ii) Water-borne diseases like cholera, typhoid, etc. are



preventable by providing safe drinking water or use of boiled water or treatment of water to kill any microbial contamination.

iii) Contagious diseases like chickenpox, measles, smallpox, leprosy, etc. can be prevented by isolating the infected persons to avoid their close contact with the healthy persons.

iv) Vector-borne diseases like malaria, dengue, cholera, etc. can be reduced by providing clean environment through public hygiene measures so as to prevent their breeding. This can be achieved through health education measures like proper sanitation of human feaces.Vectors can be killed by spraying of insecticides.

V) By providing proper and sufficient food which is essential for the proper functioning and strengthening of individual's immune system which produces antibodies to prevent the occurrence of diseases.

vi) Sexually- transmitted disease like syphilis, gonorrhoea, AIDS, etc. can be prevented by having monogamous and faithful relationship, and using condoms.

vii) Other general measures of prevention of diseases are: Proper coverage of eatables to prevent their contamination by the vectors; proper washing of fruits and vegetables before their use, keeping the food in clean containers, washing of hands before meals, proper diet to prevent diet deficiency diseases like marasmus, kwashiorkor, etc.

B) Specific prophylactic measures:

Vaccination and Immunization: Immunity or disease resistance is the ability of an organism to resist the development of a disease while the infected person with



no disease is called immune. Immunity is provided by immune system which forms specific defence mechanism of an organism. The most peculiar feature of it is that it can differentiate between "self" (body's own cells) and "non-self" (foreign microbes).

Vaccination is the most important method of preventing infection of micro-organisms, especially of bacteria and viruses. In this, a vaccine (acts as antigen) is inoculated inside the body, before the occurance of disease, to stimulate the immune cells to produce antibodies. Vaccination is based on the principle of development of immunity after having a minor attack of infectious microbes which stimulate the immune cells. The immune cells produce the antibodies which not only recover the patient but provide immunity against future infection of that microbe. In vaccinotherapy, vaccine mimics the microbe we want to vaccinate against.

Principles of Treatment (Therapy)

There are two ways of treatment of infectious diseases:

A. *Symptom*- directed treatment. This treatment is directed to reduce the effects of the diseases which are generally due to inflammation of certain body tissues characterized by fever, pain, sneezing, vomiting, loose motions, redness of skin, etc. It involves taking of medicines like anthistamine (to reduce inflammatory reactions because inflammation is generally caused by histamine), antipyretics like aspirin, crocin, etc. (to quickly bring down the temperature), analgesics (to reduce pain), etc. Though these drugs may provide some relief from the symptoms but do not bring cure from the disease so are temporary and short- lived measures and need to be taken



at regular intervals.

B. *Pathogen*-directed treatment:- This treatment is directed to kill the microbes with the help of certain chemicals. Different types of microbes have different and specific biochemical metabolic pathways e.g. metabolic pathways of bacteria may be different from those of higher organisms. The medicinal chemicals are aimed to block these pathways so as to inhibit the synthesis of toxic products used to block the metabolic pathways of bacteria may not block the metabolic pathways of other organisms. Most important therapeutic chemicals are antibiotics.

Antibiotics are the chemicals, primarily produced by certain useful micro-organisms, which in low concentrations are antagonistic to the growth of harmful micro-organisms such as pathogenenic bacteria. Some medicinally important antibiotics are: aureomycin, erythromycin, neomycin, streptomycin, terramycin, chloromycetin, etc.

Ql. *What is health? State any two conditions essential, for good health.*

A. Ecologist viewed "health as a dynamic equilibrium between internal environment & external environment" According to (WHO) world health organization defines 'health as a state of complete physical, mental & social well-being & not merely an absence of disease.' The two conditions which are essential for good health are as under:

a) *Proper Nutrition*:For keeping & maintaining good health a person should take balanced diet.

b) *Personal hygiene*

Q2. Symptoms of good health

A. The symptoms of good health are as under:

a) *Good Physical health*: Means perfect functioning of the body signs of physical health are good complexion , clear skin , bright eyes, lustrous hair, not too fat, a good appetite, sound sleep.

b) *Mental Health*: Means a person should be free from anxiety & stress.

c) *Social Well Being*: Implies harmony & integration within the individual & society.

Q3. What is disease? Define types of disease.

A. The term disease has come from two words 'des' means away & 'Aise' means 'ease' . Disease means uncomfortable or uneasy.

"Disease is a condition in which body health is impaired".

Disease is a condition of the body or some part or organ of the body in which its functions are disrupted". The human diseases are categorized into two types:

1) *Congenital disease*: These disease are present in an individual from birth due to genetic abnormality.

2) *Acquired disease*: These develop after birth & can be classified into:-

a) *Communicable diseases*:- These diseases are caused due to specific infectious agents or its toxic products capable of being directly or indirectly transmitted from man to man or from the environment (air, dust, soil etc.) to man.

b) Non- communicable disease: These diseases do not spread from infected person to a healthy person.

i) *Deficiency diseases*: These are caused due to deficiency of certain nutrients in our diet e.g. proteins,

minerals. Examples, Marasmus , Goitre, Beri - Beri etc.

ii) *Degenerative disease* :These are caused due to malfunctioning of body organs or degeneration of tissues e.g. Cancer, Kidney failure.

Q4) What are acute & chronic disease?

A. a): *Acute Diseases*: The diseases which last for very short periods of time are called acute disease e.g. common cold, dysentery etc.

b) *Chronic disease*: The diseases that last for a long time even as much as life time e.g. Cancer etc.

Q5. What is a balanced diet?

A. A balanced diet i*s* one which contains a variety of foods (proteins, fats & carbohydrates) in such quantities & proportions so that the need for energy, Amino acids, vitamins, minerals, water & roughage is adequately met for maintaining health.

Q6. What is difference between signs & symptoms?

A. Symptoms of diseases are the changes that can be presented by the patient to the doctor. e.g. headache. Signs are the basis for the conformation of any disease from symptoms.

Q7. What are various modes of transmission?

A. An infectious disease is transmitted by only one routes enhance the survival of infections agent. The modes of transmission of infectious disease are as follows:

1) Direct Transmission:

i) *By direct contact*: Diseases like leprosy, skin & eye infection are transmitted by direct contact.

ii) *By droplets*: Disease like respiratory infections transmitted by droplets i.e. coughing, sneezing or speaking & spitting etc.

iii) *By contact with soil.*
iv) Through placental transmission.
2) Indirect Transmission:-
i) By vectors ,
ii) Air borne
iii) Water borne
iv) Dirty hands & fingers.

Illness:- Is a subjective state of the person who feels that he is not well.

AIDS (Acquired Immune deficiency Syndrome)

It is also called as "Slim disease". It is caused by RNA virus called as HIV (human immuno deficiency virus). It breaks down the immune system of the body. The victim becomes vulnerable to a host life-threatening infections.

It is a protein capsule containing two short stands of genetic material (RNA). It perpetuates in human cell & has ability to destroy human T4 or helper cell. It spreads throughout the body. It can pass through the blood- brain barrier & destroy brain cells causing neurological & psycho motor abnormalities.

Source of Infection: Blood & Semen are the main source.

Symptoms: AIDS patient shows signs of unexplained diarrhea lasting more than one moth. Fatigue, loss of body weight, blood platelets count decrease that cause hemorrhage & fever.

Transmission:

1) It is a sexually transmitted disease.
2) AIDS is also transmitted by blood transfusion by blood transmitted.
3) It is also transmitted through a contemned needle & syringe.

Principle of treatment

There are two methods of treatment of an infectious disease:-

1) By reducing the effects of the disease.
2) By killing the course of the disease.

Principle of prevention

Prevention of disease is better than cure. There are two ways of prevention of a disease:

1) General way of prevention of a disease:

Preventing expose to infectious microbes.

a. For airborne microbes we can provide living conditions which are not over crowded.
b. For waterborne microbes avoid contamination of water.
c. For vector borne infections public hygiene is a basic key.

2) Specific way of prevention of a disease.

Providing proper & sufficient food.

By immune response.

Immunization

Immunization is the term used for introducing dead or weakened germs in the body of living beings for developing immunity or resistance against the particular disease.

Vaccination

Vaccination is a term cawed by Edward Jenwer for the process of administering live, weakened microbes intojthe body, for developing resistance to a particular disease.

A vaccine is a preparation used to produce active immunity to a disease in order to prevent the effects of

infection by any organism.

The process of distributing a administrating vaccines is referred as vaccination & is done mostly by infection when vaccine enters the body, it stimulate, WBC's in the body to produce antibodies against the disease -causing germs.

Q Define the following terms:-

1) *Pathogens* are the agents which are responsible for the spread of various disease e.g. viruses, bacteria, fungi etc.

2) *Droplet infection*: Droplets are airborne. The infected person thrown out tiny droplets or mucus by coughing, sneezing splitting, or even talking.

3) Xerophthalmia:- It is caused due to the deficiency of vitamin A (Retinol).

4) PEM (Protein-energy -Malnutrients):- PEM are disease caused due to deficiency of proteins, carbohydrates & fats. E.g. Marasmus & Kwashiorkor.

5) Water- Soluble Vitamins:- Vitamin B, Vitamin C.

6) Fat -Soluble Vitamin:- Vitamin A, Vitamin D, Vitamin K.

IMPROVEMENT IN FOOD RESOURCES



BIOLOGY

CLASS 9th

UNIT III

Food is the basic and essential requirement of all the living organisms. Food is the ultimate source of energy. It is required for growth, development and repair process.

The population of India is about 1.3 billion and is increasing very rapidly. To fulfill the food requirement of such a large population, we need to produce millions of tons of grain annually. This can only be done by improving the crop yield and production of livestock.

Sources of Food

1. Food from agriculture: Cereals, pulses, vegetables, fruits, nuts, oilseeds, condiments and spices

2. Food from animal husbandry: Dairy products like milk, curd, butter, meat, egg, fish and other sea products.

Food Revolutions in India

With the increase in population, there needed a sufficient increase in food production, so as to meet the food related demands of growing population. This led to the rise of the following food revolutions in India.

1. Green Revolution: Introduced to increase the food grain production.
2. White Revolution: Introduced to increase production of milk.
3. Blue Revolution: Introduced to enhance fish production.
4. Yellow Revolution: Introduced to increase oil production.

Production of Crop

Crops are the plants which are grown by humans on a large area for food and other uses, like fodder for animals and fibres and clothes, etc. For successful production of crops, we must understand the growth and development of crops, factors affecting their growth and management of crops.

General Classification of Crops

- Field Crop : food grains,pulses,oil seeds, etc.
- Plantation Crop : tea, coffee, cocoa, rubber, etc.
- Garden Crop : fruits, vegetables and ornamental plants

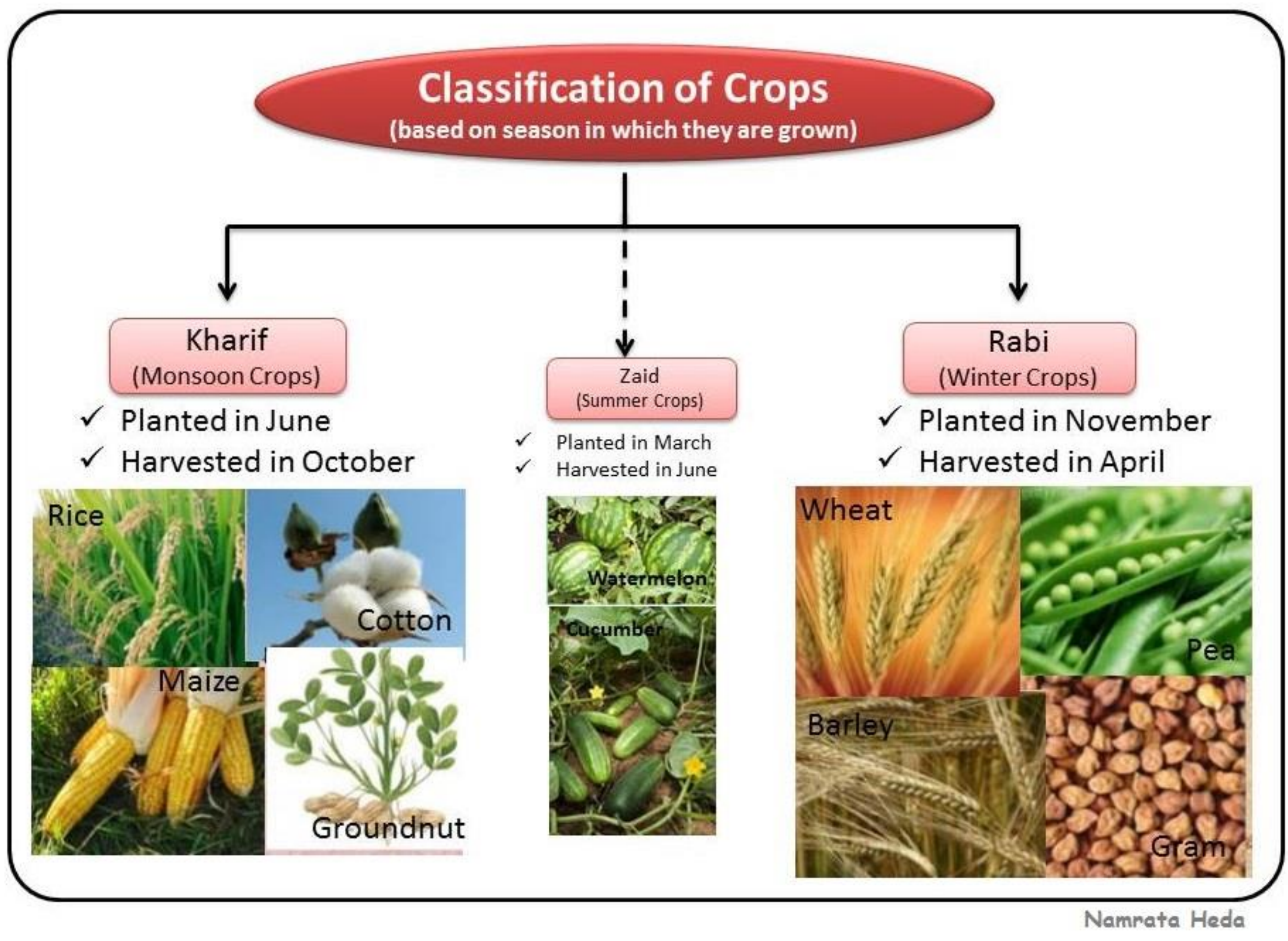
Commercial Classification of Crops

- Food Crop : Rice, wheat, oil seeds, vegetables, fruits, maize
- Fodder Crop : oats, sudan grass, sorghum
- Commercial Crop : cotton, jute, tobacco, sugarcane

Crop Seasons

Different crops require different climatic conditions like temperature, moisture and photoperiods to grow well and complete their life cycle.

S. No	Cropping Season	Time Period	Crops
1.	Rabi	Sown: October-December Harvested: April-June	Wheat, barley, peas, gram, mustard etc.
2.	Kharif	Sown: June-July Harvested: September-October	Rice, maize, jowar, bajra, tur, moong, urad, cotton, jute, groundnut, soybean etc.
3.	Zaid	Sown and harvested: March-July (between Rabi and Kharif)	Seasonal fruits, vegetables, fodder crops etc.



IMPROVENT IN CROP YIELD

Recent statistics suggest that there has been an improvement in the crop production in India over the last five years. It has been achieved by various techniques of crop improvement. First, let us see what the objectives of crop improvement are!

Objectives of Crop Yield Improvement

The objective of crop yield improvement depends on the crop type. The crop yield improvement is basically done for the following factors:

- **Higher yield:** You can achieve a higher yield of crops by developing HYV (high yielding variety) crops. This can be done by the process of hybridization and cross-breeding.

- **Better quality:** There are different reasons for improving the quality of different crops, such as improvement of the baking quality in cereals like wheat. On the other hand, pulses need to have better protein quality.
- **Biotic and Abiotic Resistance:** We should develop crops that are resistant to biotic stresses like insects and diseases and abiotic stresses like heat, salinity, and cold. This can significantly improve the crop production in the country.
- **Various Desirable Agronomic Traits:** Higher production can be achieved by developing such varieties of crops that contain the desirable agronomic traits to sustain the various threats during the production process.
- **Better and Wider Adaptability of The Crops**: By developing crops with better adaptability to changing climatic and nutritional conditions, we can stabilize the crop production, thus, leading to higher yields in crop each year.
- **Easier to Adapt to Changing Climatic Conditions:** We must concentrate on producing the varieties that are easier to adapt to the new and changing climatic conditions easily. This is one great way to improve the crop yield.
-
- **Change in Maturity Duration**

  The high-yielding varieties of crops take less time for maturing than the traditional varieties of crops. This has the following benefits

  (i) Allow farmers to grow multiple rounds of crops in a year.

  (ii) Short duration reduces the cost of crop production,

  (iii) Uniform maturity makes the harvesting process easy and reduces loss during harvesting.

How to Improve the Crop Yields?

There are three basic approaches that are adopted in our country to increase the yield from agricultural fields. They are

A. Crop Variety Improvement

B. Crop Production Management

C. Crop Protection Management



A. METHODS OF CROP VARIETY IMPROVEMENT

An improved variety of a crop is superior to the other existing varieties in respect to one or more characters. A crop variety must possess several desirable characters like, high yield, superior quality, early maturity, resistance to important diseases and insect pests, etc.

Different methods for obtaining an improved variety of a crops

(A) HYBRIDIZAITON

It is the most common method of incorporating desirable characters into crop varieties. "Hybridization" refers to a cross between genetically dissimilar plants. It involves:

1. Selection of parents, one used as female and other as male.

2. Before the flowers of the female parent open, their anthers are carefully removed, this is called emasculation. This prevents self-pollination in bisexual flowers.

3. Pollens from the flowers of the male parent are placed on the stigma of emasculated flowers.

4. Seeds produced by the flowers of the female parent are hybrid seeds.

(B) Genetic engineering

it is the deliberate introduction of a gene that provides the desired characteristic and results in genetically modified crops (GM crops).

(C) Other methods of obtaining new, genetically different variety are-

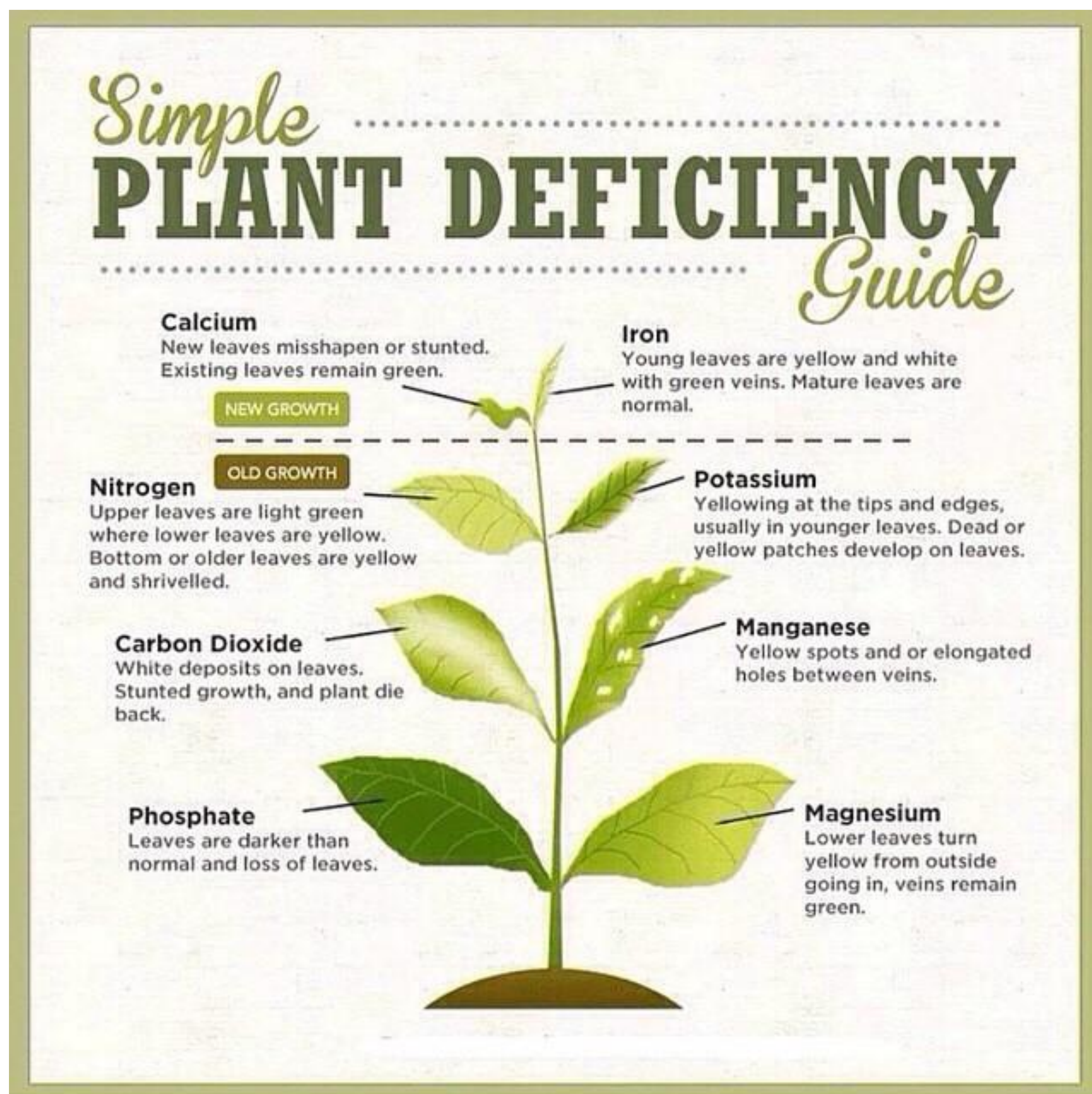
- Mutation
- Domestication
- Plant introduction

B. Crop Production Management

Crop production management is the controlling of various aspects related to crop production to obtain maximum and the best yield. The system has three components

I. *Nutrient Management*
II. *Irrigation*
III. *Cropping Pattern*

I. Nutrition Management



Plants require certain mineral elements for their normal growth, development and flourishment.

These are called as plant nutrients. There are about 30 to 40 elements found in plants but only 16 of these are essential for better growth and development of plants. The 16 elements found essential for growth and development of plants are (i) Carbon, (ii) Hydrogen, (iii) Oxygen, (iv) Nitrogen, (v) Phosphorus, (vi) Magnesium, (vii) Calcium, (viii) Sulphur, (ix) Potassium, (x) Manganese, (xi) Iron, (xii) Copper, (xiii) Zinc, (xiv) Boron, (xv) Molybdenum, and (xvi) Chlorine.

Each of these elements fulfils the following requirements to be an essential element;

(i) In the absence of the element, the plant cannot complete its life cycle,

(ii) The shortage and deficiency of the element can be corrected only by supplying that element, and

(iii)The element has the direct influence on the plant nutrition and metabolism. All elements found in the plants are derived from atmosphere, water and soil.

CLSSIFICATION OF PLANT NUTRIENTS:-

On the basis of the plant requirements the plant nutrients are chiefly classified as:

a) **Micro Nutrients:-** These include those nutrients, which are required by a plant in very small amounts for growth and development. These are also called as Minor nutrients and their deficiency in the soil lead to malnutrition of the crop plants. These nutrients act as activators for some important enzymes and are generally required in less than 1.0 mg per gram of dry weight of a plant. These nutrients may be required in small quantities but they are as essential for the growth and development of plant as the macro nutrients. The micro nutrients required by plants are iron, manganese, copper, molybdenum, zinc and chlorine.

b) **Macro Nutrients:-** The mineral elements required by the plants in large amounts are called as Macro Nutrients. These are also called as Major Nutrients. These are the nutrients which are involved in the synthesis of organic molecules in the protoplasm of cells. Out of the 13 soil nutrients, only nitrogen, phosphorous, potassium, calcium, magnesium and Sulphur are six major or macro nutrients.

Difference between Macro-nutrients and micro-nutrients

Macro	Micro-nutrients
1. Found in plants in easily detectable (large) quantities.	Found in plants in very less quantities (traces)
2. Concentration is more than 1 mg/g/ dry matter of plant	Concentration is less than 1 mg/g dry matter of plant
3. Used in building up of plant body and various protoplasm's constituents.	Used as activator for certain enzymes
4. Do not become toxic if present in excess quantity.	Becomes toxic if present in more than required quantity.
5. Examples- Carbon, Hydrogen, Oxygen, Nitrogen, Potassium, Chlorine, Copper, Molybdenum,	Examples- Iron, Zinc, Manganese.

MANURING:-

It is a process in which depleted nutrients of the soil are replenished so as to maintain the fertility of the soil to ensure a healthy yield. Adding manures and fertilizers to the soil does it, which are good sources of plant nutrients.

a) Manures:-

A manure is a natural substance obtained by the decomposition of animal wastes like cowdung, human wastes and plant residues which supplies essential nutrients and humus to the soil there by making its fertility and ensures a good produce. Though, the manures are not very rich in nutrients like Nitrogen, Potassium and Phosphorous but these are rich in organic substances like humus which improves the physical and the chemical properties of the soil.

The manures are of the following four types

1. Farm yard manure
2. Compost
3. Green manure
4. Vermi-compost
5.

b) Fertilizers:-

A fertilizer is a salt or inorganic compounds containing essential plant nutrients like Nitrogen, Phosphorous and Potassium which adds to the fertility of the soil and ensures a good and productive crop.

TYPES OF FERTILIZERS:

A chemical fertilizer can be of the following types:-

a) **Nitrogenous Fertilizer:-** A chemical fertilizer containing Nitrogen as one of its nutrients is called as Nitrogenous fertilizers. For example Ammonium sulphate[(NH4)2], Ammonium Nitrate [NH4 NO3], Sodium Nitrate (NaNO3) and Urea [CO (NH)2]

b) **Phosphatic Fertilizer:-** A chemical fertilizer which contains phosphorous as one of its essential nutrients is called as a Phosphatic fertilizer. For example, Super Phosphate or Calcium-di-hydrogen phosphate [Ca $(H_2PO_4)_2$], Ammonium phosphate [NH_4PO_4], Ammophos or Ammonium hydrogen phosphate [$(NH_4)H_2PO_4$].

c) **Potassium Fertilizers**:- A chemical fertilizer containing potassium as one of its essential nutrient is called as a Potassium Fertilizer. For example, Potassium Chloride (Kcl), Potassium Sulphate (K_2SO_4) and Potassium Nitrate (KNO_3) etc.

Difference between Manures and Fertilizers

Manure	Fertilizer
1. It is natural substance obtained by the decomposition of animal wastes and plant residues.	It is a salt or an organic compound.
2. It is not nutrient specific and removes the general deficiency of soil.	It is nutrient specific and it can provide specific nutrient to the soil.
3. It is not easily soluble in water.	It is easily soluble in water and is readily absorbed by plants.
4. It provides humus to the soil.	It does not provide humus to the soil.
5. It is prepared in the fields or rural homes.	It is prepared in the factories.
6. It is voluminous and bulky, so it is not convenient to store or transport.	It is compact and concentrated, so it is easy to store and transport.



ADVANTAGES OF FERTILIZERS:-

Chemical fertilizers have many advantages over manures. Some of these are:

(i) Chemical fertilizers are less bulky. They are easy to store, transport and apply.

(ii) Chemical fertilizers are nutrient specific; they fulfill the requirement of a particular nutrient. (iii)Chemical fertilizers are soluble in crop water and hence are easily absorbed by plants.

DISADVANTAGES OF USING CHEMICAL FERTILIZERS:-

Modern agriculture relies heavily on chemical fertilizers. High doses of these chemicals do increase

crop yield but these chemicals have many hazards also. The important disadvantages of using chemical fertilizers are:

(i) These chemicals get washed off through irrigation, rainfall as drainage and reach rivers, lakes and other water bodies and pollute them, disturbing the natural ecosystem.

(ii) The continued use of chemical fertilizers can cause drastic alterations in the soil chemistry and affect the crop yield.

(iii)The excessive use of nitrogenous fertilizers makes the water rich in nitrates, which makes the water unfit for drinking.

(iv)The chemical fertilizers, especially nitrogenous can increase biological oxygen demand (BOD) of water leading to the destruction of aquatic animals like fishes and aquatic plants. This phenomenon is known as eutrophication.

II) **IRRIGATION OF CROPS:-**

The process of supplying water to a crop growing in a field by means of canals, reservoirs, wells and tube wells etc. is known as Irrigation. It helps in the development of a crop plant by dissolving the essential nutrients of the soil, which are then absorbed by a plant through its root hairs. It is also supplies two essential nutrients-hydrogen and oxygen to a crop plant needed for its proper growth and development.

IMPORTANCE OF IRRIGATION

(i) Supply of essential elements, i.e., hydrogen and oxygen.

(ii) Germination of seeds – water is an essential condition fro germination of seeds. It mobilizes the reserve food in the seed and makes it available for growth of embryo.

(iii)Essential for growth and elongation of roots.

(iv)Essential for absorption of nutrient elements by crop plants.

(v) Maintains turgidity of the cells.

SOURCES OF IRRIGATION

The various source of irrigation used in our country are rivers, canals, reservoir, ponds, wells and tube well etc. In addition to these, a major portion of the cultivated land in our country is dependent on rains for its irrigation.

1. **TANKS:-** These are small storage reservoirs, which store the run-off from smaller catchment areas.

   The water stored is rarely sufficient for use all year round but it lengthens the growing period.
2. **CANAL SYSTEM:-** It is an extensive network of canals, which receive water from a reservoir or river. They are divided into branch canals, which are further divided into distributaries. These distributaries irrigate the field.
3. **ROTATION SYSTEM:-** This provides adequate irrigation to all the fields when the water supply is short. Each field is given water by rotation.
4. **RIVER LIFT SYSTEM:-** This involves drawing water directly from rivers to irrigate areas close to the river. This is done when the canal flow is insufficient or irregular.
5. **WELLS:-** wells are made to exploit ground water. These are of 2 types
   - Dug Wells – water here is collected from water bearing strata.
   - Tube wells – they tap water from the deeper strata of earth. Water is drawn

by pumps, hence continuous water supply can be ensured by this system.

6. **RAINWATER HARVESTING:-** It is a technique to recharge groundwater by capturing and storing

rainwater by constructing special water harvesting structures. In areas of high rainfall . rain water from roof tops is collected into water storage tanks from where water is diverted to some abandoned well and lifted by using a hand pump.

7. **WATERSHED MANAGEMENT:-** This involves building small check-dams which stores run-off or rainwater.

(i) It increases the ground water level.

(ii) Reduces the soil erosion.

(iii)Water can be treated and reused.





III) CROPING PATTERNS

There are different ways of growing crops to give higher yield.

a. Mixed cropping.
b. Inter cropping
c. crop rotation

(a) Mixed Cropping

The process of growing two or more different crops together in the same field is called mixed or multiple cropping. It is also a means for restoring soil fertility as the products and waste material from one crop, help the growth of other crop plants and vice versa.

In mixed cropping different crops are not grown in different fields, but many such crops are grown together in one and same field. For example, cotton and groundnut, maize and urd and soybean are generally grown together in multiple cropping. One crop in the mixture is to be regarded as major crop and one or more others as subordinate.

ADVANTAGES OF MIXED CROPPING

1. <u>Saving of time and labour.</u> Multiple cropping saves time and labour of the farmers.
2. <u>Optimum utilization.</u> It helps in optimum utilization of the soil.
3. <u>Avoids depletion in soil nutrients.</u> It avoids depletion of soil nutrients due to different nutrient requirements of different crops in the same field.
4. The waste materials and products released by one crop may be beneficial to other crop in mixed or multiple cropping.
5. <u>No risk of crop failure.</u> When two crops different nature are grown simultaneously, risk of total crop failure is minimized due to uncertainty in monsoon.

6. Variety of produce. It is available in the form of cereals, vegetables etc. for human beings and fodder for animals.
7. Increase in yield. Growing of a legume crop along with cereal will increase the yield of cereal due to coverage of nitrogen deficiency in soil.
8. Minimizing pest damage. In mixed cropping when different crops are grown together chances of pest infestation is highly reduced. Because a particular type of plant is infected by a particular type of pest.

(b) **Inter Cropping**

Is growing two or more crops simultaneously on the same field in a definite pattern. A few rows of one crop alternate with a few rows of a second crop, for example, soyabean + maize, or finger millet (bajra) + cowpea (lobia). The crops are selected such that their nutrient requirements are different. This ensures maximum utilization of the nutrients supplied, and also prevents pests and diseases from spreading to all the plants belonging to one crop in a field. This way, both crops can give better returns.

ADVANTAGES OF INTER CROPPING

1. Insurance against crop failure under rain fed conditions.
2. Higher productivity per unit area.
3. Intercropping system utilizes resources efficiently.
4. Prevents pests and disease from spreading to all the plants belonging to one crop in a field.
5. Both crops can give better returns.

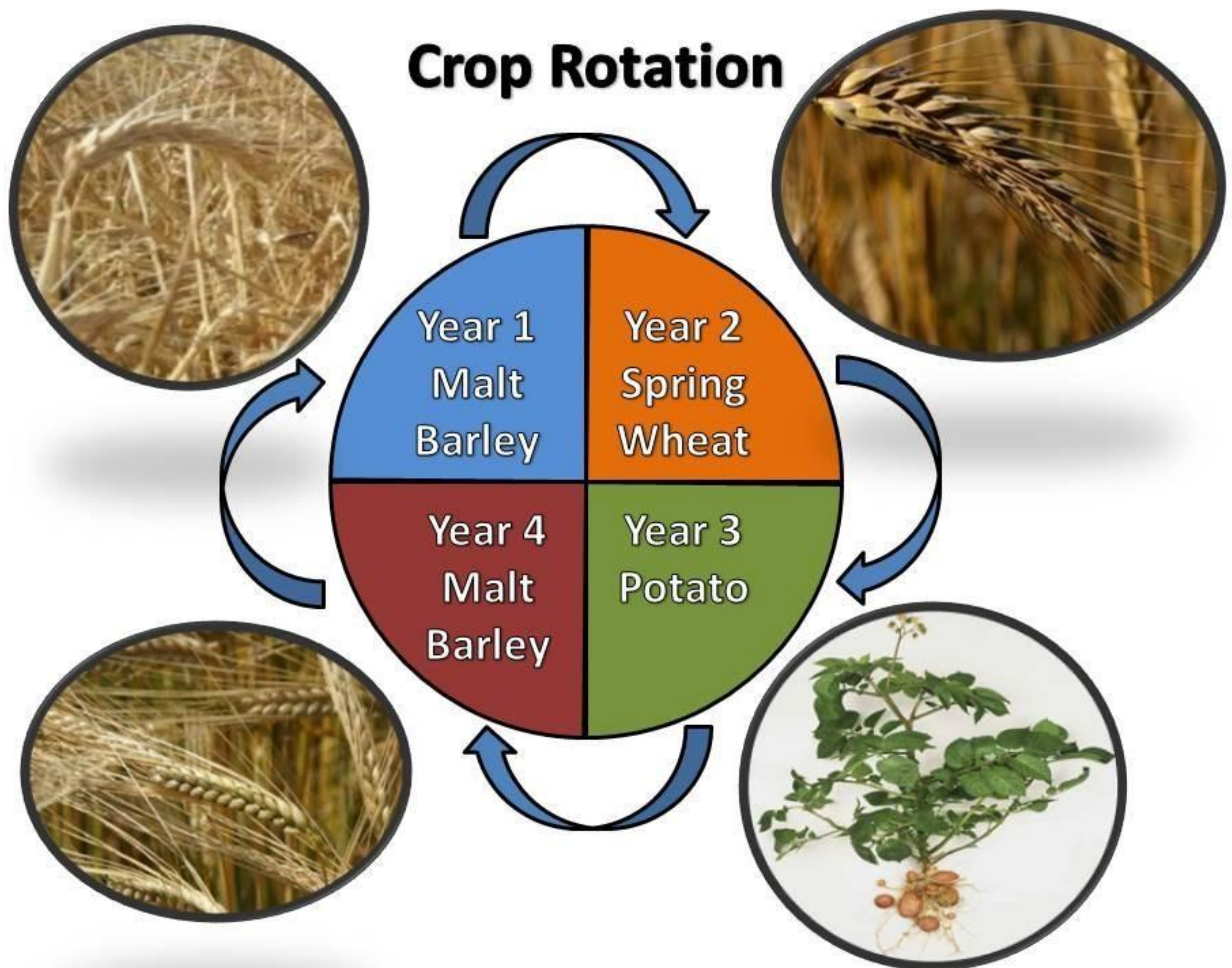
(c) **Crop Rotation**

This is a process of growing different crops alternately or in a pre-planned succession in the same field. In crop rotation, the leguminous crops like pulses, beans, groundnut, clover, etc. are sown in between the seasons of cereal crops like

maize, wheat , rice , mustard, pearl millet, etc.

ADVANTAGES OF CROP ROTATION

1. Crop rotation improves the fertility of the soil.
2. It saves nitrogenous fertilizers.
3. It helps in pest and weed control.
4. It regulates the used of plant nutrients from the soil.
5. Two or three crops can be grown in a year, which means a good harvest.
6. The chemical nature of the soil does not change.



SELECTION OF CROP FOR ROTATION

Crops should be selected on the basis of.

1. **Availability of moisture.** The moisture condition, length of rainy season and type of soil decides the choice of crop rotation. In rain-fed areas either the crop is grown in summer season and field remains vacant during winters or field is kept vacant for conserving moisture in summer and rabi crops are grown during winters.
2. **Availability of Inputs.** Depending on the availability of inputs like irrigation facilities, fertilizers, pesticides, implements and manpower the farmers can harvest two or four crops in a year. Rice, wheat, mung, mustard, sugarcane, and berseem are some of the major components of crop rotation in these areas.

In case of limited inputs, farmers harvest on or two crops in a year.

3. **Condition of soil.** Some crops like sugarcane, maize, potato, rice and wheat require high amount of nutrients in the soil. While leguminous crops can also grow on less nutrient-rich soil. So, depending upon the nutrient status of the soil, the crop is selected for rotation.
4. **Duration of crop maturity.** The two or more selected drops should be such that their maturing cycle does not clash. One of them should have a long cycle while the other should mature faster.
5. **Marketing and processing facility.** The crops should be selected according to its demand in the market, presence of storage and processing facilities.

C. Crop Protection Management

In order to get maximum benefits, we should take appropriate steps to protect vegetation, mainly plantation crops from being damaged.

Crop protection management includes the protection of crops from weeds, insects pests and crop diseases.

WEED CONTROL

Weeds are unwanted plants, which grow of their own along with main crop plants.

Examples of common weeds are.

- *Amaranthus,*
- *Chenepodium,*

- *Parthenium (carrot or congress grass),*
- *Wild oats (avena),*
- *Grasses etc.*
- *Xanthium (gokhroo)*
- *Cyperinus rotundus (motha)*

A weed may be a crop plant or plant of another variety of the same crop. If barley or mustard plants appear in wheat field, they are called weeds, because they have appeared out of place.

The growth of weds in the field is harmful because:-

(i) They compete with main crop plant for nutrients, light, water, carbon dioxide, space and fertilizers. As a result, crop yields are reduced considerably.

(ii) Weeds excrete certain chemicals into the soil which inhibit germination and growth of other plants in their vicinity.

(iii)Weeds harbor pests and diseases, which may attack the crops.

(iv)Loss of quality-contamination of food grain with weed seeds of Datura, Argemone, Brassica etc., is harmful to human health also, they give an odd odour to flour.

(v) Menaces to human health – weeds harbor organisms like mosquitoes that cause of transmit diseases. Some weeds are poisonous and others produce pollen, which causes allergies.

WEEDING:-

The wild or unwanted plants which grow along with a cultivated crop in a field are called as weeds and the process of removal of these unwanted plants or weeds is referred to as weeding. The growth of weeds is harmful to a crop plant because they consume a lot of fertilizers, water, sunlight, nutrients and space meant for the crop plants and reduces the quality as well as yield of a crop. These also spread the crop pests and diseases by acting as alternate host to insects and micro-organisms. Some of the common weeds found in the rice and wheat fields are Wild oat, Grass, Amaranthus,

Chenopodium and Convolvulus etc. Parthenium, Solanum, Mut grass.

METHODS OF WEEDING:-

Weeding is either done by hand i.e. by pulling the weeds out or by using the various agricultural implements like trowel or harrow. In addition, these can also be destroyed by the following two methods.

a) Chemcial Method:- This method involves destruction of weeds by spraying special chemicals called weedicides which killo and checks the growth of weeds. For example, 2,4,D [2,4,Dichloro Phenoxy Acetic Acid], MCPA[2 Methyl, 4 Chloro Phenoxy Acetic Acid] and Butachlor etc. Trizines, 2,4,S-T[2,4,5 Tri Chloro Phenoxy acidic acid, Borais, Chlorates.

b) Biological Method :- In this method, some appropriate insects or organisms are deliberately introduced into the crop field having weeds. These insects or organisms cause selective destruction of the weed plants without harming the main crop. For examples Cochineal insects are used to eradicate the opuntia weeds.

c) Safe storage of Food materials:- Safe storage of food materials like food grains, fruits and vegetables is very essential for a number of reasons like: -

1) It ensures availability of a food material throughout the year.
2) It ensures and facilitates smooth distribution of the food materials for the far and distant areas of the country.
3) It protects the stored food materials from pests, insects rodents and diseases.
4) It also reduces the spoilage and damage of the stored food material.
5) It maintains the nutritive value of the food materials.

FACTORS EFFECTING DAMAGE OF FOOD MATRERIALS:-

The stored food grains and other food materials can be damaged either by living

(biotic) or by non living

(abiotic)

factors: -

1) Non-Living or Abiotic Factors:- The various abiotic factors, which cause damage to the stored food materials are:

a) Temperature: - The maximum growth rate of the insects, which damage the stored food materials, varies between 300C to 320C and micro-organisms are active between 300C to 400C. Thus, the damage to the stored food materials can be minimised by storing it at a lower temperature than feasible to insects, micro- organisms and enzymes

b) Moisture: - For the safe storage of the food materials, the moisture content should be 14% by weight. Any increase in the moisture content accelerates the rate of decay of food materials caused by micro- organisms. However, any decrease in the moisture content reduces the identity as well as the nutritive value of a food material.

c) Humidity: - Higher humidity and higher temperature produces growth of moulds and fungi on the stored food grains which increases the moisture content of the grains and the grains become wet or damp.

d) Material of the Container: - The container used for the storing different types of the food materials should be selected carefully. It should not be toxic or should not produce harmful substances in combination with the stored food material.

2) Living or Biotic Factors: - The various biotic factors which cause damage to the stored food grains include

a) Rats (Rodents), Birds and Animals:- The maximum damage to the stored food grains is caused by rodents or rats and on an average six rats consume as much as food grains as a man does. Birds also eat and contaminate the stored food grains with their dropping (excreta) and feathers, and make it unfit and poisonous. However, birds also cause substantial damage to the standing crops of fruits, vegetables and food grains.

b) Insects and Micro-organisms:- Insects and micro-organisms cause infestation which not only lowers the quality of the stored food materials but also spoils it by producing certain poisonous chemicals called as toxins. These chemicals when consumed cause

damage to liver. Micro-organisms also decompose fats into fatty acids, proteins into amino acids, ammonia and sulphur compounds. The strong smell of these products of decomposition of food coming from the stored food materials confirms their decay and spoilage

c) Enzymes:- Enzymes are proteins which speed up and regulate many chemical reactions taking place in the living organisms, vital for their normal growth and development. These enzymes change the chemical composition of the various food materials, leading to their spoilage by producing undesirable chemicals unfit for human consumption.

CHARACTERISTICS OF A GOOD STORAGE STRUCTURE:-

A good structured storage not only stores the food grains but also reduces its loss. The essential features of a good storage structure are:-

- It should not allow the rats, insects, birds and other animals to enter into it.
- It should be made in such a way so that spraying of pesticides or fumigation for controlling insects and pests is efficiently possible.
- It should be easy to clean and convenient for periodic inspections of the stored food materials.
- It should be waterproof and should protect the stored food materials from temperature and humidity contrasts.
- It should be situated away from the sources of infection, like garbage, dumps, chemical industries etc.
- It should be maintained at a constant but low temperature.



ANIMAL HUSBANDRY:-

It is a branch of science which deals with the various aspects of maintenance and breeding of domestic animals (livestock). These aspects include feeding, breeding, heeding, and weeding.

- **Breeding :** it is done to obtain animals with desired characters. Through breeding, we can develop high milk – yielding and high meat- yielding cattle.
- **Feeding :** it deals with the study of proper food (called feed), mode and time or feeding of different animals
- **Weeding :** This concerns with the elimination of uneconomical animals.
- **Heeding :** It means the proper care and management of animals

FEEDING

The food eaten by animals is called as feed and the practice of providing food to animals as feeding. The feed given to cattle should contain food having sufficient quantity of carbohydrates, proteins, fats vitamins and minerals. In addition, a feed should also contain adequate amount of roughage and water.



Composition of feed:-

The cattle feed contains two main substances as explained under:-

a. Concentrates:- It is a mixture of substances rich in various nutrients essential for proper growth and development of the cattle. These are provided by cottonseeds, oilseeds, oil cakes, cereal and grains and rice polish etc. All these substances possess a high nutritive value and thus have a great influence on the productive yield of these animals. E.g. 50-60 gms- NaCl, Barssen, Lucerna, cowper,Alpha-Alpha.

b. Roughage:- It is a coarse and fibre substances having a low nutritive value. They neither provides energy nor builds the body of an animal, but for important for the normal functioning of the digestive system. These are provided by the substances like hay, fodder and silage etc.

SHELTER

Domestic animals require a proper shelter, which protects them from heat, cold, rain prelatures and disease causing microorganisms. It also reduces discomforts of the

animals and increases their productive yield.

Characteristics of a good animal shelter

A good animal shelter should possess the following characteristics features:

1. It should be clean, dry airy and well ventilated.
2. It should receive an adequate amount of sunlight.
3. It should have enough space and ideal place.
4. It should have proper arrangement for the drinking water.
5. It should have proper arrangement for the disposal of animal excreta like dung and urine.
6. It should be strong so that it may provide protection to animals from the predators.
7. It should have hygienic surroundings so that it may safe guard the animals from various diseases.

ANIMAL PROTECTION FROM DISEASES

Domestic animals require an intimate care and protection from microorganisms and disease. When an organism is attacked by a disease, it not only affect its health but also reduces its productive yield.

SYMPTOMS OF A SICK OR AN ILL ANIMAL:-

The symptoms which can be used to detect a sick animal are as under:

1. It stops eating its food.
2. Its productive yield is reduced.
3. It becomes lazy or inactive, looks tired and remains isolated.
4. It either moves slowly or limps.
5. Its eyes turn red and body becomes hot but shivers.
6. It passes loose dung and colored urine.
7. It coughs wheezes, sneezes and shivers.
8. It pours water from mouth and nose.
9. Its ears drop down.

10. Its body becomes dull.

TYPES OF ANIMAL DISEASES:-

Depending upon the causal agent of a diseases are broadly classified into three main classes Viz.

a. **Viral Disease:-** These diseases are caused in animals by viruses . For Example, Foot and Mouth disease of Cattle, Pox and Dermatitis of sheep and Goat etc
b. **Bacterial Disease:-** These diseases are caused in animals by bacteria. For Example, Fowl Cholera, Diarrhoea of chick, Rinderpest and Anthrax etc.
c. **Fungal Diseases:-** These diseases are caused in animals by Fungi. For Example, Aspergillosis of poultry.

PREVENTION OF ANIMAL DISEASES:-

Some of the elementary steps in animal management, which helps in preventing animal diseases and ensures a good health for animals, are:-

1. Animals should be fed regularly with a clean and nutritive feed.
2. Animals should be placed in spacious, airy, dry and clean shelter having hygienic surroundings.
3. Animals should be provided with clean drinking water.
4. Animals should be bathed and groomed frequently to protect them from skin infection.
5. Animals should be vaccinated at the proper age and unfit animals should be kept in isolation.
6. External parasites like Lice, Ticks, Mites and rodents should be controlled applying dilute pesticides.
7. Animals should be treated gently and not frightened at all.

ANIMAL BREEDING:-

Breeding means animal production. It is practiced by two main methods.

i. **Natural breeding:-** In this traditional method , an indigenous cow is cross bred with a high milk yielding foreign breed of bull by mating process.

ii. **Artificial Breeding OR Artificial Insemination:-** In this method, semens are collected from a desired male and then injected into the genital tract of a female with the aid of suitable instrument and techniques, so as to obtain a better breed of the animal. The better breed or hybrid obtained contains only the desired character and is superior in every aspect like high milk yield, high disease resistance and longer life span etc.

PRECAUTIONS IN ARTIFICIAL INSEMINATION:-

The various precautions to ensure high fertility in artificial insemination method are as under:

1. The semens stored and used should be of the high quality male.
2. The female selected should be in proper health and age of reproduction.
3. The process should be done at the proper time of the productive cycle (Heat Peroid).
4. Injection of semen should be done by proper instruments with a suitable technique.

ADVABTAGES IF ARTIFICAIL INSEMINATION:-

The various advantage of the artificial insemination method are as under:-

1. It gives an opportunity for making selective breeding of the animals having desired characters.
2. It is a cheaper method as semens form a single bull can be used to impregnate about three thousand cows at distant places.
3. It is better method of breeding than the natural method.
4. It is more reliable than the natural method of breeding.

It increases the productive yield by producing high milk yielding animals.

SIGNIFICANCE OF ANIMAL HUSBANDRY

In animal Husbandry, farming of cattle, goat, sheep, poultry and fish is undertaken. They help in.

1. Increasing milk production
2. Increasing egg production
3. Increasing meat production
4. Increasing fish production
5. Improving quality of products
6. Producing honey and bees-wax through bee keeping.

High milk yielding Breeds of Cow:- In India, there are about 32 indigenous breeds of cows and all of them do not yield a good quality of milk. The high milk yielding breeds of cows developed through cross breeding are Karan-Swiss, Friesion-Sahiwal, Karan-Fires, Jersey and Holstien-Friesion etc. Murrah(2000L) Bull/Lactation period.

BREEDS OF BUFFALO

There are ten breeds of buffaloes in India. The best-known breeds of Indian buffaloes are: Nagpuri, Mehsana (Gujarat), Jaffrabadi, Surti, Murrah (Punjab and Haryana).

POULTRY

The word ‘poultry’ is used for birds, which cab be raised in domestic conditions for economic purposes. It includes chicken, ducks, geese, turkeys, guinea fowls, pigeons and quails. It is undertaken to raise domestic fowl for egg production and chicken meat. Egg-laying birds are called layers, while meat- yielding birds are called broilers.

ADVANTAGES OF POULTRY

1. It provides eggs and meat, which are highly nutritious food. They are a rich source of animal protein, minerals and vitamins and contain a right kind of fat good for

health.

2. Contributes to the economic upliftment of farmers.
3. Poultry droppings mixed with litter form rich manure.
4. It is also a means of recreation.

ADVANTAGES OF CROSS-BREED

- These consume less feed to give same amount of meat as compared to desi breeds.
- These consume less feed to produce same number of eggs as compared to indigenous breeds.
- They are high egg laying birds.

The **focus of cross breeding programs** is to develop new varieties because of the following desired traits:

- Number and quality of chicks.
- Dwarf broiler parent for commercial chick production.
- Summer adaptation capacity or tolerance to high temperature
- Low maintenance requirements.
- Reduction in the size of the egg-laying bird with ability to utilize more fibrous cheaper diets formulated using agricultural by-products.

POULTRY CARE

It involves the following steps:

(a) Maintenance of temperature and hygienic conditions in poultry housings.

(b) Poultry feed.

(c) Prevention and control of diseases and pests.

(a) **Maintenance of poultry housings.** These should be well ventilated (having fresh and cool air) and should extend in east-west direction (so that enough sunshine is available in winter). It must be rat and snake proof because rats not only eat the eggs but also spread diseases in the poultry house. As the photoperiod (of about 14-18 hours)

regulates the growth of chicken and egg production, so poultry housed should be kept lit at night. It should be kept at about 55-75^{o} F as the chicken show maximum growth at this temperature. The floor of poultry house should be covered by litter (e.g. paddy husk, saw dust, crushed maize cobs, etc.).

(b) **Feeding.** The chickens are fed on grains (wheat, rice ,barley, jowar, bajra etc.), oil cakes , bone-meal, meat meal, green vegetables, etc. Growing chickens, called growers, need a balanced feed containing carbohydrates (as energy source), proteins (19%), fats (1%), minerals (calcium, phosphorus, sodium , etc.), vitamins (A, B and D), etc. a good feed makes the poultry healthier and they lay more eggs.

The daily food requirements (called ration) of broiler are different from those of layers e.g. the ration for the broilers should be protein and fat rich and with high amounts of vitamin A and K.

DISEASE CONTROL

(i) **Vaccination.** It involves preventive inoculation which reduces the loss of poultry during an oout break of disease.

(ii) **Ectoparasites like lice**, mites and ticks can be controlled by spraying insecticides like malathione. (iii)**Endoarasites** like *Taenia* (tape worm) and round worms can be controlled by wormicides. (iv)**Fungal diseases** like Mycosis and Thrush can be controlled by using Bordaeus mixture.

(v) **Protozoan diseases** like coccidiosis can be treated with sulpha drugs.

(vi)**Bacterial diseases** can be treated by sulpha drugs and antibiotics.

FISH AS FOOD:- Fish from an important constituent of human diet. Our country has a long coastline and many fresh water bodies. Thus, it has vast resources of marine as well as fresh water fish. Fish is a valuable source of food rich in proteins. Fish proteins are

easily digestible. In addition, fish has the following uses for

(i) **Medicinal use:-** Fish liver oil (cod liver oil) is an important source of vitamin A and D.

(ii) **Industrial use:-** Body oils of some fishes like herrings and sardines are used for the manufacture of edible oil and margarine.

(iii)**Agricultural use:-** They are used as an organic manure in the field.

(iv)**Feed for farm animals: -** Dried fish are used to provide proteins to farm animals.

(v) **Adhesive:-** Skin and bones of fish are used to make high quality glues and adhesives.

FISHERY :- Fishery is the business or occupation of catching fishes. There are two ways of obtaining fish:

(a) **Capture fishing: -** It is the type of fishing in which fish is caught directly from their natural resources. The source can be either sea water or fresh water.

(b) **Culture fishery:-** It is that type of fishery in which fish is cultivated in artificial water bodies called breeding ponds.

POLYCULTURE:- It is a novel method of fish farming in which many species of fish are cultured together in a pond or water body. It is also called poly culture.

ADVANTAGESOF POLYCULTURE:-

- Ensures full utilization of natural food in the body without competing with each other.
- Increases the yield from the pond.

BREEDS OF FISH:- The following breeds of fish are used in fish farming:

INDIGENOUS FRESH WATER MAJOR CARPS

- Catla catla (Katala).- Catla is the fastest growing carp.
- Labeo rohita (Rohu),
- L. calbasu (calbasu) and
- Cirrhina mrigala (mrigla)

EXOTIC FRESH WATER BREEDS

- Common carp, Mirror carp, Chinese carp, Silver carp, and Crass carp etc.

SALT WATER DISHES WHICH CAN LIVE IN SEAWATER

- Chanos, mullets.

MAIN OPERATIONS IN PISCICULTURE

Fish culture involves the following main operations:

1. Collection, transport and sowing of fish seeds.
2. Tending the hatchlings.
3. Nursing the fry.
4. Rearing the fingerlings.
5. Production of table sized fish.
6. Harvesting the fish grown to table size.

MARINE FISHRIES

India's marine fishery resources include 7500 km of coastline and the deep seas beyond it. Popular marine fish varieties include pomphret, mackerel, tuna, sardines, and Bombay duck. Marine fish are caught using many kinds of fishing nets from fishing boats. Yields are increased by locating large schools of fish in the open sea using satellites and echo-sounders.

INLAND FISHERIES

Fresh water resources include canals, ponds, reservoirs and rivers. Brackish water

resources, where seawater and fresh water mix together, such as estuaries and lagoons are also important fish reservoirs. While capture fishing is also done in such inland water bodies, the yield is not high. Most fish production from these resources is through aquaculture.

APICULTURE :- Is the process of rearing of honeybees in artificial hives, called apiaries, for the production of honey on a commercial level. An artificial and movable beehive used for commercial production of honey is called apiary.

Honeybees belong to phylum arthropoda and class insecta. Some indigenous species of honeybees are:

APIS DORSATA :- It is commonly called rock bee or gaint bee (being largest sixed). Though it produces maximum amount of honey, it is ferocious and a migratory bee, hence difficult to domesticate.

APIS CERANA INDICA :- It is commonly called Indian bee. It can be domesticated easily as it is very gentle in nature but a less honey producing species.

APIS FLORA :- It is commonly called little bee(being smallest sized). It is also very docile but yield is less.

Exotic species of honey bees that are introduced to increase the honey production are:

1. **Apis mellifers.** It is commonly called Italian bee. It is preferred over the indigenous species for the commercial production of honey because of its docile nature, high yield of honey, high egg production, and good defense mechanist.

IMPORTANCE OF APICULTRE

(a) Products of honey bees include honey, bees wax, bee venom and royal jelly.

(i) **Honey.** Honey has high food value, medicinal importance (used as laxative,

antiseptic and sedative, so is used against disorder of digestion, dysentery, vomiting and stomach and liver problems), manufacturing of cakes, etc. Its iron and calcium promote the growth.

(ii) **Bees wax.** It is used in cosmetics, paints ointments, polishes, microtomy, etc. (iii) **Bee venom.** It is used to cure certain diseases like gout and arthritis.

(iv) **Royal jelly.** It is used as tonic to heart patients and growing children. (b) Honey bees are chef cross-pollinating agents.

(c) Apiculture provides additional income generating activity to the farmers.

PASTURAGE: -

The term pasturage refers to plants and vegetation on which grazing animals feed. Pasturage is the flora from which honey bees collect nectar, pollen, and bee glue. These decide the quality and quantity of honey produced by honey bees.

Topic: Diversity

DIVERSITY IN LIVING ORGANISMS:

Ql) What is classification? What is the need of classification?

A) Classification of organisms may be defined as system of arrangement of organisms into different groups & sub-groups on the basis of their similarities differences & relationship.

To find an organism of known characters from a vast number of organisms is simply impossible. Thus a system of classification is needed when dealing with anything in large numbers.

Q2) What is the importance of classification?

A) The importance of classification is given below:

1. It makes the study of a wide range of organisms easy.
2. It is a tool by which one can deal with great diversity of organisms.
3. It helps us to understand inter relationship between different organisms.
4. It helps in understanding the evolution of organisms.
5. It is required for scientific study.
6. It plays a vital role in applied biology i.e. in agriculture, horticulture, public health etc.

TWO KINGDOM SYSTEM OF CLASSIFICATION:

This system of classification was suggested by Carolus Linnaeus in 1758.Under this system of classification, all living organisms were divided into two kingdoms i.e. kingdom plantae & kingdom animalia. The members of kingdom "plantae were plants & that of kingdom animalia were animals. Under this



system of classification, bacteria & fungi were classified in plant kingdom because they show close resemblance with plants rather than animals. However several objections were raised against this classification & finally this system of classification was discarded.

FIVE KINGDOM SYSTEM OF CLASSIFICATION:

It was in 1959 that Robert H. Whitaker suggested a five kingdom system of classification .He grouped all bacteria under one kingdom i.e. kingdom monera.The five kingdoms grouped under his classification are as:

1. Kingdom monera
2. Kingdom protista
3. Kingdom fungi
4. Kingdom plantae
5. Kingdom animaiia

HIERARCHY OF CLASSIFICATION:

It is also known as linnean hierarchy because it was first proposed by Carolus Linnaeus.It is the arrangement of organisms in definite sequence of categories depending upon their relative dimensions.It includes seven obligate categories:

1. *Species*: It forms the basis of hierarchy. Species is a group of individuals with similar morphological characters which are able to breed among themselves to produce fertile off-springs of their own kind. e.g: Horse & Ass belong to same genera (Equus)but both have different species i.e E.cabalus & E.asinus
2. *Genus*: It is a group of closely related species with common ancestory e.g.potato & brinjal are placed in same genus Solonum but have different species.

3. *Family*: It is a group of closely related genera e.g. Solanum & Datura have been placed in same family Solanaceae.

4. *Order*: It is a group of closely related families e.g.Canidae(dogs,wolves,etc) & Felidae(cats,tiger,etc) belong to same order Carnivora.

5. *Class*: It is a group of closely related orders e.g. chordates like rats,dogs,bats,camel,monkey belong to same class Mammalia.

6. *Phylum*: It is a group of closely related classes e.g. phylum Chordata includes classes like Pisces,Amphibia,Reptiles,Aves & Mammalia.

7. *Kingdom*: It is a group of closely related phyla e.g.all animals are included in Kingdom animalia.

For man, the hierarchy is as:

Kingdom: Animalia

Phylum: Chordata

Class: Mammalia

Order: Primata

Family: Hominidae

Genus: Homo

Species : Sapiens

TAXONOMY: It is the branch of science which deals with principles & procedures of identification, classification & nomenclature of organisms.

NOMENCLATURE:

The science of providing distinct & proper names to organisms so that they

can be easily recognized & differentiated from others is known as nomenclature.

BINOMIAL NOMENCLATURE:

This system of classification was developed by Carolus Linnaeus in 1753. According to binomial nomenclature, the scientific name of an organism is made up of two parts:

The genus name & the specie name e.g.: Rana Tigrina(frog) where Rana is the genus name & Tigrina is the specie name

RULES FOR BINOMIAL NOMENCLATURE:

1. Each organism is given only one name consisting of two words-genus & species.
2. The generic name is written first. It is followed by the species name.
3. The generic name always starts with a capital letter & species name with a small letter.
4. When printed both the names of an organism should be written in italics.
5. When hand written both the names of an organism should be underlined. e.g: Homo sapiens

Common names & their drawbacks: Common name is the name given to an organism in a particular language & region of the world.

Drawbacks:

1. The organism which is known by one name in one country may be known by some other name in other parts of the world. Thus leading to the confusions.
2. Some common names have incorrect meaning eg Silver fish, Jelly fish, and Star fish. They belong to different phyla even if all appear to be fishes.
3. Sometimes same organism is known by several names in the same

language.

KINGDOM MONERA (prokaryotae)

General characteristics:

Kingdom monera has been divided into 2 subkingdoms:

Archaebacteria and Eubacteria

1. *Archaebacteria*: are mostly autotrophs. They derive the energy they need from the oxidation of chemical energy sources like ammonia, methane, hydrogen sulphide. Archaebacteria are divided into following three groups:

(a) *Methanogens*: They manufacture methane as a result of their metabolic activities. They show anaerobic respiration and die in presence of O_2.They are found in swamps and marshy lands.

(b). *Thermoacidophiles*: They are found in extremely hot and acidic environments such as hot springs.

(c).*Halophiles*:They are found in very salty environments like salt lake and dead sea.

2. Eubacteria: They generally lack membrane bound organelles such as nucleus, chloroplasts & mitochondria.A circular strand of DNA present in the nucleoid serves as single chromosome. Almost all bacteria are covered by a rigid cell wall that protects them from osmotic rupture in water & gives definite shape to their body.

KINGDOM PROTISTA

This group includes some unicellular algae, protozoans, unicellular fungi.

PHYLUM PROTOZOA:

General characteristics:

1. They are unicellular,mostly aquatic(fresh water or marine) animals.

2. They are solitary or colonial, free living or parasitic, symbiotic.

3. No fixed body shape.

4. Uninucleate, binucleate or multinucleate.

5. Locomotion by means of pseudopodia, flagella or cilia.

6. Nutrition is mostly heterotrophic.

Phylum protozoa is divided into 5 classes:

a. Mastigophora(eg:Euglena,Volvox)

b. Rhizopoda(eg:Amoeba,Entamoeba)

c. Sporozoa(eg:Plasmodium)

d. Ciliophora (eg:Paramoecium,Opalina)

KINGDOM FUNGI

General characteristics:

1. Simple non-green plants which are not photosynthetic. They are heterotrophic & eukaryotic organisms. Some fungi are parasitic (Puccinia,Ustilago) while some are saprophytic (Mucor,Rhizopus).
2. The body of a multicellular & filamentous fungus is called a mycelium and is composed of several thread like structures known as hyphae.
3. Fungal Cell wall is made of chitin & cellulose.
4. The reserved food is stored as glycogen.

LICHENS

General Characteristics



1. Lichen is a symbiotic association between a fungus and a blue green algae.
2. The algal component of lichen is known as Phycobiont & the fungal component as mycobiont.
3. The fungus absorbs water & minerals & supplies it to algae.The algae inturn prepares food & supplies it to the fungus.
4. Lichens are found as slow-growing coloured patches on rocks, bark of trees & even on ground.

KINGDOM PLANTAE

Kingdom plantae is divided into following divisions:

1. *Division Thallophyta:*

General characteristics:

1. They are the most primitive & simple plants. Body is in the form of an undivided thallus i.e. the body is not differentiated into root, stem & leaves.
2. Mostly aquatic but some are also terrestrial i.e. live on land near moist places.
3. They contain photosynthetic pigments such as green, red, brown etc.
4. They are autotrophic & the reserved food is stored as starch.
5. The cell wall is made of cellulose
6. Vascular tissues are absent. Examples: Ulothrix, Cladophora, Spirogyra, Ulva etc.

2. *Division Bryophyta*:

General characteristics:

1. They are small multicellular green land plants. They are confined to shady damp places. They are also known as 'Amphibians of plant kingdom'.

2. The plant body is flat, green,thallus in liverworts (Riccia, Marchantia) & leafy, erect structures in mosses (Funaria, Sphagnum)

3. True root, stem & leaves are absent.

4. True vascular bundles are absent.

5. Gametophyte is attached to substratum by means of hair like outgrowths, the rhizoids which absorb water & minerals from the substratum. Examples: Riccia, Marchantia, Funaria, Sphagnum, Anthoceros.

3 DIVISION PTERIDOPHYTA:

General characteristics:

1. They are found in shady or damp places.

2. The plant body is differentiated into root, stem & leaves.

3. True vascular bundles are present.

4. These plants have no flowers & hence don't produce seeds.

5. Some examples are: Selginella, Lycopodium, Equisetum.

4 DIVISION GYMNOSPERMAE:

General characteristics:

1. They are most primitive & simple plants.

2. They produce naked seeds which are not enclosed within fruits.

3. They are usually perennial, evergreen & woody plants.

4. They consist of following two groups:

   (a) Cycadae eg:Cycus etc

   (b) Coniferae eg:Pinus,Cedrus,Ginkgo.

4 DIVISION ANGIOSPERMAE:

General characteristics:

1. They are highly evolved plants & produce seeds which are enclosed within the fruit.

2. They are also known as flowering plants as the reproductive organs are aggregated within a flower.

3. In seeds plant embryos have cotyledons (seed leaves).On the basis of no. of cotyledons angiosperms are divided into 2 groups:

(a) *Dicotyledonae (dicots):*

   a. Their seeds have 2 cotyledons.
   b. Their leaves have reticulate venation.
   c. The root system has a prominent tap root
   d. The flowers have five or multiple of five petals. Examples: pea, potato, sunflower, rose etc.

(b)Monocotyledonae (monocots):

1. Their seeds have only one cotyledon.
2. Their leaves have parallel venation.
3. The root system consists of fibrous roots.

4. The flowers have three or multiple of three petals. Examples; Maize,Wheat,Rice,Coconut etc.

Kingdom Animalia:

Some Important Terms:

1. Body Plan:

i) *Cell aggregate Body Plan*: There is little differentiation of cells, e.g. sponges.

ii) Blind Sac Plan: Body has a cavity with one opening that functions as mouth & anus. Digestive track is,therefore, incomplete. e.g. coelenterate, flat worms,

iii) Tube within a tube plan: Body wall forms an outer tube while digestive tract forms an internal tube. It has two openings, mouth & anus, so that the digestive tract is complete.

2. *Coelom*: It is the name of body cavity which is filled with a fluid & is lined by peritoneum derived from Mesoderm. Animals which don't have a body cavity are called Acoelomates (e.g. Porifera, coelenterates, and flatworms).

Some animals possess a false body cavity or Pseudocoel that develops from blastocoels & is not linked by peritoneum, e.g. round worms. Animals having true coelom are called coelomnates. In arthropods & molluska the actual or true coelom is reduced. Instead, they contain a body cavity filled with blood known as haemocoel & is present due to open circulatory system.

3. Germinal Layers: These are primary layers which differentiate at the time of gastrulation in a developing embryo. All the tissues & organs develop from the germinal layers. There are three germinal layers- ectoderm (outer), mesoderm (middle) & endoderm (inner). Animals having two germinal layers (ectoderm & endoderm) are called diploblastic, e.g. porifers , coelenterates. Animals with three germinal layers (ectoderm, mesoderm & endoderm) are called triploblastic, viz, platyhelminthes to chordates.

Body Symmetry: Most animals including humans have symmetrical right & left

sides. In other words, the two sides of the body are mirror images of one another. Such type of body symmetry is called bilateral symmetry. Some animals have radial body symmetry which can be defined as an arrangement of usually similar parts in a regular pattern around a central axis, e.g. coelenterates, Echinoderms

Metamorphosis: It is the change of form & structure that occurs during transition from larval to adult stage. It is found in many invertebrates, protochordates, some fishes & amphibians.

1. Phylum Porifera

General Characteristics of Phylum Porifera

1. They are mostly marine with few exceptions which live in fresh water (e.g. spongilla).
2. They are sessile (stalk-less), asymmetrical or radially symmetrical. They are commonly called sponges.
3. Sponges are diploblastic, multicellular but simple structures.
4. Body is perforated by numerous pores, the Ostia that open into a canal system having canals & chambers. It also has an outlet for H_2o called Oscula. (osculum). Oscula are analogous to mouth while as osculum is analogous to cloaca.
5. Mouth, digestive cavity & anus absent.
6. Asexual reproduction occurs by budding & gemmules & sexual by fertilization. They can regenerate.

Phylum Porifera is divided into three classes:

1. Calcarea e.g: Sycon (scypha)

2. Hexactinellida e.g: Euplectella (venus flower basket)

3. Demospongiae e.g: spongilla, Euspongia.

Phylum Coelenterata or Cnidaria

General Characteristics:

1. Most of the coelenterates are marine but few are fresh water like Hydra. Some live in colonies (coral physalia) while others live solitary (Hydra)

2. They are multicellular, diploblastic animals with tissue level of organization.

3. Body shows radial symmetry.

4. The animals have blind sac body plan. There is single opening which serves both as mouth & anus. It lead to a cavity called Coelenteron.

5. They posses endoblasts which are stinging cells & their function is to paralyse the prey by injecting poison.

6. Respiratory, circulatory & excretory organs absent.

7. Nervous system is of primitive type.

8. They show the phenomenon of polymorphism. The two polymorphic forms are polyp & medusa when polyp undergo asexual reproduction medusa is formed & when medusa undergo sexual reproduction polyp is formed.

Coelenterate is divided into 3 classes:

1. Hydrozoa e.g: Hydra, Obelia, Physalia.

2. Scyphozoa e.g:Aurelia (Jelly fish), Rhizostoma.

3. Anthozoa e.g: Pennatula , Tubipora, Gorgonia etc.

Phylum Platy helminthes (flat worms)

General Characteristics

1. The body of these animals is soft, dorsoventrically flattened, bilaterally symmetrical, ribbon like.

2. They are triploblastic & acoelomate animals.

3. Digestive system is incomplete as they posses Blind sac type of body plan.

4. Circulatory, respiratory & skeletal systems are absent.

5. Excretion is brought about by special cells called Flame Cells (ciliated tiny bulb-like excretory structures of invertebrates).

6. Hermaphrodite i.e. both male & female reproductive organs occur in the same individual.

Platyhelminthes are divided into three classes:

1. Turbellaria — e.g. Dugesia, Planaria

2. Trematoda — e.g. Fasciola (liver fluke), Schistosom, (blood fluke)

3. cestoda- e.g. Taenia Solium(Pork tape worm)

4. PHYLUM NEMATODA

General characteristics:

1. These animals are bilaterally symmetrical, triploblastic, pseudocoelometes & unsegmented.

2. Body worm-like, cylindrical or flattened.

3. Body is covered with tough and resistant cuticle, cilia absent.

4. Digestive system is complete as they posses Tube with in tube body plan.

5. The animals are unisexual i.e sexes are separate. There is no asexual reproduction.

6. Some nematodes are parasitic & are pathogenic,i.e produce diseases in the



hosts. For e.g. Elephentiasis in which enlargement of leg foot takes place due to infection caused by Wucheria- bancrofti. The disease spread by bites of mosquito, similarly, Ascaris & Enterobius live in human intestine & cause ascariasis & enterobiasis. Examples: Ascaris,(round-worm), Wucheria bancrofti (filarial worm), Enterobius (Pinworm of human).

PHYLUM ANNELIDA (Segmented worms)

General characteristics:

1. They live in variety of habitats. Mostly aquatic, some terrestrial, some free living.

2. These animals are triploblastic, bilaterally symmetrical, with organ system level of organisation.

3. They have got tube within tube body plan i.e. digestive system is complete.

4. Exoskeleton is absent, body is covered by a thin cuticle.

5. True coelomate animals with closed blood vascular system.

6. Excretion by means of paired Nephridia(tubular excretory organs).

7. Circulatory system is of closed type i.e blood flows in definite blood vessels.Blood is red due to presence of haemoglobin. RBC's are absent.

8. Locomotion usually takes place by means of parapodia (appendages).

9. Reproduction is by sexual means Sexes may be united (hermaphrodite) or separate.

Phylum annelida is divided into three classes:

1. Class polychaeta e.g. Neries, aphrodite
2. Class oligochaeta e.g. Pheretima(earthworm), Eutypheus
3. Class hirudinea e.g. Hirudinaria(leech)

PHYLUM ARTHROPODA (jointed feet)

General characteristics:

1. Phylum Arthropoda includes animals with jointed appendages or legs. For Example, prawns,: insects, Spiders, Scorpions, Crabs, Ticks, Centipedes, Millipedes .

2. Body is segemented.Segements are grouped to form 3 parts.i.e, head,thorax and abdomen.

3. An eoskeleton made of chitin are strengthened with proteins & $CaC0_3$ occurs on outside.

4. Animals are triploblastic, bilaterally symmetrical & have tube within tube body plan.

5. Mostly cutaneous respiration is absent due to presence of exoskeleton. Respiration takes place by gills,trachea or book lungs(simple structures having parallel, leaf-like plates terminating in blood vessels.

6. Circulatory system is of open type i.e.blood flows in open spaces (lacunae).Blood is colourless & contain WBCs only.

7. Excretory organs are malphigian tubules or green glands

8. Sexes are separate.

Phylum Arthropoda is divided into 6 classes:

1 Crustacea eg; prawn,crab

2 Chilopoda eg ;centipede

3 Diplopoda eg; milipede

4 Insecta eg; cockroach,mosquitoes,butterfly ,housefly etc

5 Aracnida eg; scorpion,spider,Tick

6 Onychophora eg; peripatus

PHYLUM MOLLUSCA

GENERAL CHARACTERISITICS:

1. They are mostly aquatic but some forms are terrestrial also.
2. They are triploblastic , coelomate, bilaterally symmetrical animals having tube within tube body plan.
3. Body is soft,unsegemented with a variety of shapes.
4. Body divided into Head,Visceral mass & Foot.The entire body is covered by a fold of thin skin, called mantle which secretes the shell.
5. Coelom is greatly reduced & body cavity is called haemocoel.
6. Respiration by gills (ctenidia),mantle or air sac popularly called "lung".
7. Excretion by a pair of meta nephridia or kidneys.
8. Sexes are usually separate.

Phylum Mollusca is divided into 5 main classes:

Class l: polyplacophora e.g. Chiton

Class 2: Gastropoda e.g. Pila, Helix

Class 3: Scaphopoda eg; Dentalium

Class 4:Pelecypoda e.g. Unio,Teredo

Class 5: Cephalopoda e.g. Loligo, Sepia,Octopus

PHYLUM ECHINODERMA: (spiny skinned animals)

GENERAL CHARACTERISTICS:

1. They are exclusively marine, carnivorous & benthonic i.e. found at the bottom of sea.
2. Body triploblastic, coelomate, radially symmetrical i.e. pentamerous (5 sided) in adults.
3. Body lacks head but has oral & aboral surfaces.
4. A true coelom lined with peritoneum is present.A part of it is modified into ambulacral or water vascular system, that helps in locomotion.
5. Locomotion takes place by tube feet.
6. Respiration takes place through gills or tube-feet.
7. Circulatory systems is of open type.
8. Excretory organs is absent.
9. Digestive system is usually complete.
10. Reproduction sexual, asexual or by regeneration. Sexes are separate.

Phylum Echinodermata is divided into 5 classes:

Class 1 Crinodiea eg; Antedon

Class 2 Holothuroidea eg; Holothuria

Class 3 Echinoidea eg; Echinus

Class 4 Asteroidea eg; Asterias

Class 5 Ophiuroidea eg; Ophiura



PHYLUM HEMICHORDATA:

GENERAL CHARACTERISTICS:

1. Exclusively marine, solitary or free living, detritus feeders (dead organic matter like humus) like earthworm.
2. Body soft, worm-like, bilaterally symmetrical these animals possess a combination of chordate & non chordate characters.
3. Body divided into proboscis, collar and trunk.
4. These animals resemble chordates in having gill slits and they lack notochord.
5. No nephridia are present. Single glomerulus connected to blood vessels may have excretory function. Examples: Balanoglossus, Cephalodiscus

PHYLUM CHORDATA:

General characteristics:

1. They possess three diagnostic features-notochord, hollow nervous system, gill slits.

NOTOCHORD: It is an elastic, solid, rod like structure of turgid cells which develop between dorsal nervous system & alimentary canal. Muscles for body movement are attached to it. In vertebrates notochord is replaced by cranium & vertebral column.

DORSAL NERVOUS SYSTEM: It is present mid- dorsally above the notochord. It may differentiate into brain & spinal cord.

PHARYNGEAL GILL SLITS:

1. They are paired perforations present on the lateral side of the pharynx. In lower chordates, they take part in circulation of water for respiration.

In higher chordates, they occur only in embryonic stages.

2. Body bilaterally symmetrical, triploblastic & coelomate.
3. Heart ventral in position having closed blood vascular system.
4. Complete digestive system.
5. A cartilaginous or bony endoskeleton is present in majority of members (vertebrates)

Group vertebrata is divided into 2 subphyla:

a. Agnatha: having vertebral column & cranium but without true jaws

b. Gnathostomata: having jaws & paired appendages.

Gnathostomata is divided into 6 classes:

Class 1: chondrichthyes:

a. They are marine fishes with completely cartilaginous endoskeleton.

b. The mouth is ventral in position.

c. Skin is tough & covered with placoid scales.

d. Respiration by gills. Five or seven pairs of gill-slits are present. The gill-slits are not covered by Operculum or gill-cover.

e. Locomotion occurs by fins.

f. Tail or caudal fin is heterocercal (unsymmetrical).

g. Heart is 2 chambered.

h. Cloaca is present i.e. common opening for removal of wastes & mating. Examples: Scoliodon(shark), Torpedo (electric ray), Trygon (sting ray)

Class 2: Osteichthyes

General characteristics:

1. They are marine & fresh water fishes having wholly or partly bony endoskeleton.

2. Body is generally spindle shaped.

3. Skin is either naked or covered with cycloid or ctenoid scales.

4. Mouth is usually terminal in position.

5. Four pairs of gills are present & are covered with operculum. Fish obtains oxygen dissolved in water using gills.

5. Caudal fin is homocercal(symmetrical).

6. Cloacae are absent.

7. Oviparous & fertilization is external.

8. Heart is two chambered.

Examples: Labeo(carp),Anabas(climbing perch),Exocoetus (flying fish), protopterus (lung fish)

CLASS 3 AMPHIBIA

General characteristics:

1. As per evolution they were the first animals among chordates that shifted towards land. They live on land but lay their eggs in water.

2. Skin is without scales & possess mucous glands to keep it moist.

3. Body divided into head & trunk. Neck is not well differentiated.

4. Two pairs of pentadactyl (5 digit) limbs are present. Digits or toes without claws.

5. Heart is 3 chambered i.e two auricles & one ventricle.

6. Respiration by gills, lungs, skin or by buccal cavity(mouth).



7. Oviparous & fertilization is external in frogs & toads but internal in salamanders & apoda.

8. Excrete either ammonia or urea.

9. Cold blooded (exothermal) i.e. temp. of body varies according to that of surroundings. Examples: Ichthyophis, Amphiuma, Rana, Xenopus

CLASS REPTILIA

General characteristics:

1. It includes lizards,snakes,crocodiles & tortoises.They are terrestrial or aquatic vertebrates. Skin is dry & horny with epidermal scales.

2. Body divided into head,neck ,trunk & tail.

3. Two pairs of pentadactyl (5 digit) limbs are present. Digits or toes are with claws. Limbs are absent in snakes & some lizards.

4 Heart is 3 chambered i.e two auricles & one ventricle. Only crocodiles have 4 chambered heart.

6 Respiration by lungs only .No gills.

7 Oviparous & fertilization is internal but a few reptiles are oviviparous.

Examples: Testudo(tortoise),Hemidactylus(wall lizard), Chameleon,Python(ajgar) crocodylus (muggar).

CLASS$_5$ *AVES:*

General characteristics:

1 They are warm-blooded, tetrapodous vertebrate with various flight adaptations.

2 Body covered with feathers. Sweat glands are absent.

3 Body divided into head, neck ,trunk & tail.

4 Fore limbs are modified into wings for flight. Kiwi has vestigial wings.

5 Hind limbs possess 4 clawed digits & are adapted for walking, perching or swimming.

6 Jaws are modified to form beak. Teeth are absent.

7 Heart is 4 chambered i.e having two auricles & two ventricles.

6 Respiration by lungs only.

7 Oviparous & fertilization is internal i.e lay fertilized eggs.

8 Cloaca is present.

9 Birds have highly developed voice & show high level of parental care Exam ples: Gallus(chicken),Passer (sparrow), Corvus(crow),Columba(pigeon),Spectacular(parrot),Bubo(owl).

CLASS6 MAMMALIA:

General characteristics:

1 They *are highly* developed vertebrates & are warm-blooded.

2 Skin is glandular, it possess sweat & oil(sebaceous) glands.

3 Presence of mammary glands in females in order to feed their young ones.

4 Presence of external pinnae (ear) 5 Teeth are thecodont(protected within sockets) & heterodont (of different types).

6 Two pairs of pentadactyl (5 digit) limbs are present.Digits or toes in Limbs are never more than 5 & end in claws,

7 Respiration by lungs only.

8 Heart is 4 chambered i.e having two auricles & two ventricles

9 Most of the mammals are viviparous but some mammals like Duck billed platypus & Scaly ant eater lay eggs.



10 Parental care is highly developed. Examples: Macropus, Manis, Rattus, Canis, Homo, Felis

Textual Questions

Q#l Which do you think is a more basic characteristic for classifying organisms:

a) The place where they live.

b) The kind of cells they are made of. Why?

Ans. The classification of organisms on the basis of habitat is misleading because habitat serves as a point which different organisms share in common. For example, the animals that live in the sea include corals, whales, octopuses, fishes etc and all of these differ from each other in their characteristics dramatically even if they share a common habitat.

So, the more basic characteristic for classifying organisms is the kind of cells they are made of because - The cells contain genetic material i.e. DNA. DNA is the chemical basis of heredity in any cell of an organism which contains the information for making that organism. Members of a species containing similar DNA in their cells therefore possess similar information and hence they resemble each other.

Q#2 On what basis are plants and animals put into different categories?

Ans. The basic characteristic on which plants and animals are put into different categories is their body design. The characteristics of body design used for classification of plants are different from those for classifying animals. This is because the basic designs are different, based on the need to make their own food (plants) or to obtain it (animals). The body of plants is designed in such a way (like presence of leaves) that they can synthesize their own food using some basic raw materials. Similarly, the body of different animals is designed differently to obtain and eat food (like presence of heterodant teeth etc.)

Q3. *Which organisms are called primitive and how are they different from the so- called advanced organisms?*

A. Primitive organisms are those organisms which have pro ancient body designs that have not changed very much with the passage of time. The primitive organisms differ from the advanced organisms in the sense that advanced organisms have acquired different changes in their body designs with the passage of time so as to face the different changes that are occurring in the environment continuously.

Q4. *Will the advanced organisms be the same as complex organisms? Why?*

A. An advanced organism means higher organisms. Since there is a possibility that complexity in design will increase over evolutionary time so we can say that advanced organisms are comparable to complex organisms.

Q5. What are the advantages of classifying organisms?

A. There are two main advantages of classifying organisms:

1. Classification helps us to recognize and describe the basic taxonomic units i.e. species.Thus we can say that classification helps in the recognization of species.

2. Classification helps us to devise (design) a way of grouping these units (species) on the basis of their resemblances and relationships.

3. Classification makes it possible to deal with the enormous diversity of living organisms.

Q6. Explain the basis for grouping organisms into five kingdoms.

A. The five kingdoms arrangement of organisms was introduced in 1969. The three criteria (basis) for this arrangement are:

1. Complexity of cell structure (prokaryote or eukaryote).

2. Complexity of the organism's body (unicellular and simple or multicellular and complex).

3. Mode of nutrition i.e. whether the organisms produce their own food through the process of photosynthesis.



4. Whether the organisms digest or absorb their food.

5. Whether they possess a specialized body design.

Q7. What is the primary characteristic on which first division of organisms is made?

A. The primary characteristics on which first division of organisms (Monera) is made is the complexity of cell structure i.e. they are all prokaryotes and their size is small (1 to few microns in length).

Q8. How are the criteria for deciding divisions in plants different from the criteria for deciding sub-groups among animals?

A. 1. The first criteria for classification of plants into divisions depends on whether the plant body has well- differentiated distinct components.

2. The second criteria is based on whether the plant body has got vascular bundles for transport of water and food.

3. The third criteria is based on the ability to bear seeds and whether the seeds are enclosed within the fruits.

Similarly the first criteria for classification of animals into different sub-groups are based on complexity of cell structure and mode of nutrition (mostly heterotrophic).

The second criteria are based on the extent and type of body differentiation found.

Q9. In the hierarchy of classification, which group will have the smaller number of organisms with a maximum of characteristic in common and which will have the largest number of organisms.

A. In the hierarchy of classification, species will have the smallest no.' of organisms with a maximum of characteristics in common and kingdom will have the largest no. of organisms.

Topic: Prevention Of Drug Abuse And Sexually Transmitted Diseases

Ql. What does the term addiction mean?

Ans. Addiction is commonly called as substance abuse. It is another term for drug abuse. It can simply be defined as a pattern of harmful use of any substance for mood altering purposes. Addiction is a state of physical and psychological dependence on drugs.

Q2. Define a drug.

Ans. A drug is any natural product or synthetic chemical that can be used to modify a chemical process or processes in the body.

Q3. What is substance abuse?

Ans. Medline medical encyclopedia defines substance abuse as "the use of illicit drugs or the abuse of prescription or over the -counter drugs for purposes other than those for which they are indicated or in a manner or in quantities other than directed."

Q4. Write various problems suffered by adolescents.

Ans. In the adolescence period, an adolescent suffers from a large no. of problems like development of acne, hypochondria, loneliness, craziness for different things, physiological aberrations, neurasthenia i.e. chronic mental and physical fatigue, phobia, post traumatic stress disorder, eating disorder and response to suicide behavior and addiction.

Q5. Write the characteristics of drug addiction.

1. An over powering desire or need to continue taking the drug and obtain it by any means.
2. A tendency to increase the dose.
3. A psychological and a physical dependence on the effects of the drug.
4. Detrimental effects on the individual and on society.

Q6. Write the symptoms of drug addiction.

1. Loss of interest in sports and daily routine.
2. Loss of appetite.
3. Loss of body weight.
4. Unsteady gait.
5. Clumpsy movements
6. Tremors

Q7."Adolescents are more prone to substance abuse". Justify the statement.

Ans. Adolescents are more prone not only to social pressure to experiment with addictive substances, but also more to the damage caused by such substances. Their minds and bodies are still developing, so teen drug use can progress into addiction faster.

Q8. How do the drugs influence human brain?

Ans. Addictive drugs are mood altering drugs because they have the ability to alter the activity of nervous system. The activity and function of the nervous system can be modified by a wide range of chemicals and drugs having either a direct effect on nerve cells or by producing changes in neurotransmitters.

Q9. Write a note on different types of drugs.

Ans. There are various types of drugs such as:

Sedatives and tranquillizers, which overcome mental irritability and excitement causing drowsiness or sleep, also called as antidepressants.

1.Alcohol:-It is a simple organic compound. 'It decreases functional efficiency, lowers the activities of CNS and causes loss of sensation.

2.Tobacco: It is derived from leaves of tobacco plants. It contains highly poisonous alkaloid called nicotine. It causes large no. of diseases e.g. cancer, carbon monoxide poisoning etc.

3. Opioids:- These are the drugs which bind to specific opioids receptors present in our CNS and gastro intestinal tract e.g. heroin which is obtained from latex of poppy plant.

4. Cannabinoids:- These are groups of chemicals which interact with cannabinoid receptors. It is obtained from the plant cannabis sativa e.g. Hashish, Charas etc.

5.Coca alkaloid or Cocaine:- It is obtained from coca plant e.g. cocaine, dhatura etc.

Q10 Describe the four symptoms of Drug Addiction.

1.Strong cravings for drugs:-These cravings are intense urges which result in loss of concentration. These cravings are so severe that they cause excessive consumption.

2.Poor physical health:- Prolonged drug abuse causes health problems such as rapid weight loss or weight gain, bloodshot eyes,

bad breath, body shakes, tremors etc.

3.Neglecting responsibilities:- Drug addicts neglect their responsibilities at work, school and athome. They choose the substance over their education, career and family and ignore the consequences of their actions.

4.Withdrawal:- As the effect of the drugs wear off, the person may experience symptoms such as anxiety, trembling, sweating, depression,fatigue, loss of appetite and headaches.

QlI What are the reasons of drug abuse?

1. Calming of exciting effects.
2. Escape from reality.
3. Search for awareness and mysticism.
4. Masking pain.
5. Blunting anxiety.

Q12 What are STDs? Name a few.

Ans The diseases or infections which are transmitted through sexual intercourse with infected persons are cabled Sexually Transmitted Diseases (STDs) e.g. Gonorrhea, syphilis, AIDS, Chlamydiasis etc.

Q13 Give the full form of AIDS and HIV.

Ans. AIDS :Acquired Immune/ Immuno Deficiency Syndrome.
HIV :Human Immunodeficiency Virus.

Q14 Enlist the modes of transmission of AIDS.

Ans. The transmission of AIDS causing virus i.e. HIV from one person to other person occurs through
following means:-

1. Through sexual intercourse with infected person.
2. Through transfusion of blood, blood products and contaminated equipments.
3. Through infected mother to child.

Q15 What are the common myths related with the transmission of AIDS?

Ans. HIV does not spread through casual everyday contact such as Handshake, Living in same house, Sitting with

someone in crowded bus, Sharing of food, books, computer etc with anyone. Using common wash basins, toilet seats etc.

Q16 What measures would you recommend to prevent/ check the spread of AIDS?

1. Medical instruments should be properly sterlized.
2. Doctors and paramedicose should wear gloves.
3. Used syringes and needles should be carefully disposed off.
4. The secretions and excretions should be disposed off carefully.
5. Care should be taking while using endoscopes, dialysis, dental services.
6. Utmost care should be taken while child birth, disposal of dead body of HIV infected patient.
7. Safe sex.

Q17 Name at least two methods, used for detection of HIV infection.

i) ELISA Test:- Enzyme Linked Immuno-sorbent Assay,
ii) Western Blot Test

Q18 How should an AIDS patient be treated?

Ans. AIDS patient should not be treated with prejudice, negative attitudes, abuse and maltreatment. Such parents should not be stigmatized but they should be empathized.

Q19 What are the four symptoms of AIDS?

1. Weight loss
2. Chronic diarrhoea
3. Persistent cough.
4. Smelling of lymph glands.

A. Match the following:

1.	Opioids	3	Erythroxylum coca
2.	Cannabinoids	1	Papaver

somniferum

3. Coca alkaloids 2. Cannabis sativa

4. Tobacco 4. Nicotiana tobaccum

Fill in the blanks.

1.The word drug has been derived from Dutch word droog.

2. 'Nicotiana tobaccum belong to family solanaceae.

3. The substance which decreases functional efficiency is called sedative.

4. Tobacco is plant product.

5. The vital organ which is affected by tobacco is lung.

B. Match the following:

Do it yourself.

